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ROYAL SOCIETY

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TASMANIA

PAPERS AND PROCEEDINGS

OF THE

ROYAL SOCIETY

OF

TASMANIA

FOR THE YEAR

1908.

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Royal Society of Tasmania.

1908.

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The responsibility of the statements and opinions given in the following Papers and Discussions rests with the individual authors or speakers: the Society merely places them on record.

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PAPERS.

Royal Society of Tasmania.

ABSTRACT OF PROCEEDINGS.

APRIL 7, 1908.

A Meeting of the Society for the transaction of ordinary business, and the reconsideration of the Balance-sheet submitted with the Annual Report for 1907, was held at the Museum on Wednesday evening, April 7, 1908.

Mr. T. Stephens, M.A., F.G.S., in the chair.

Mrs. C. S. Agnew, Messrs. Hugh Armstrong, F.R.C.S., W. A. Harvey, M.B., Lyndhurst F. Giblin, B.A., A. W. Courtney Pratt, W. Minchin Nicholls, and A. R. Reid were elected Fellows of the Society.

In reference to the question of the reconsideration of the Balance-sheet for 1907, the Chairman announced that Mr. Bernard Shaw, their recently-appointed Honorary Treasurer, had taken a great deal of trouble in going through the accounts of the Society for the last four years, and would now furnish any information that was required on the subject.

Mr. Shaw laid on the table printed accounts showing the receipts and expenditure for the years 1904 to 1907. The Balance-sheet for 1907 had been amended by the transposition of figures. The error in the accounts of the Morton Allport Memorial Fund was connected with the purchase of a valuable work for the Memorial Library when the funds in hand were insufficient for the purpose, and the deficiency was made good by a loan from the General Funds of the Society. There should have been some explanatory note to show that the amount of this loan was a debit balance against the Memorial Fund, which would be repaid to the Society as soon as the next instalment of interest was received. The Balance-sheets for 1904-5-6 had now been compiled, and, with the revised Balance-sheet for 1907, had been examined by the Auditor and certified as correct.

Mr. A. J. Taylor thought the Society might now congratulate itself on the fact that it had a business-like statement put forward, and he claimed that the course he took at the previous meeting, in moving that further consideration of the Balance-sheet be postponed, was fully justified by the clear statement of accounts which was now before them. Mr. Bernard Shaw had taken a vast amount of trouble in going through the accounts for the years which had been mentioned. He (Mr. Taylor) did not at the previous meeting for a moment dream of casting any reflection on the Council or the late Secretary.

Mr. Shaw, in reply to Dr. Crouch, said a grant to the medical section for 1905 did not appear in the accounts, as it was not paid.

Dr. Noetling raised the question of insurance. He noticed there was an item in the 1904 accounts for insurance, but not subsequently. The valuable books in the library could not be replaced for £5,000.

Mr. Shaw said the books were now reinsured as the property of the Society for £1,000.

The motion for the adoption of the accounts was then put and carried.

Mr. J. W. Gould moved, Dr. Crouch seconding the motion, "That a hearty vote of thanks be given to Mr. Bernard Shaw for the large amount of trouble he had taken in examining the accounts of the Society for the past four years." The motion was put and carried with applause.

APRIL 13, 1908.

The Monthly General Meeting of the Society was held at the Museum on Monday evening, April 13, 1908.

Mr. Russell Young in the chair.

The Chairman referred in feeling terms to the cause of the absence of Sir John Dodds (Lieutenant-Governor and Acting-President of the Society), and felt sure that the meeting was in deep sympathy with him and his family.

The Secretary to the Council (Mr. Robert Hall) notified the receipt of valuable literature from kindred societies in all parts of the world, from Russia, Argentina, Canada, the Mediterranean countries, and Great Britain. The Smithsonian Institute, U.S.A., had sent books of very great value.

Mr. Hall then gave an account of the travels of himself and friend through Siberia to Moscow and St. Petersburg, and then on to London. He described the fauna and flora met with in a journey of 6,000 miles on the little-known Lena River, in Siberia. The people, their modes of living, etc., were well illustrated and described. He said we have on our beaches all round the coast millions of little wading birds, very little larger than sparrows, called sand-pipers, which stay with us over Christmas till about April, and then fly 8,000 miles northwards to Siberia, where they breed their young, arriving just after the ice melts on the largest swamp in the world, called the Tundra, extending over 2,000 miles east and west. In the following October they started again, with their young birds, back to Tasmania. Then there was a fish popularly known as the herring in Bass Strait, which migrated past the Philippines and Corea right up to Kamschatka, making a return trip the same year, and this went on year after year. Most of the

food fishes deposited their eggs out in the open ocean, but the herring was quite an exception. It was not known in which rivers this herring deposits its eggs; possibly in the southern streams. It was wonderful how those birds made such long flights annually, and especially how the young birds, which travelled for the first time, got back to the land of their birth. They seemed to have some special sense of direction. These birds had been migrating in this way, possibly, for millions of years, and from a time when Siberia had a very different climate from what it has to-day, as was evidenced by geological impressions of tropical plants that once grew there. Now it had a terribly severe winter, during which quicksilver remained frozen in barometers and such instruments for months. He presented views, and described Irkutsk, the capital of Eastern Siberia, Yakutsk, centre of the Siberian fur trade, and Verkoyansk, one of the coldest places in the northern hemisphere; yet, in the spring, birds migrating between Tasmania and Siberia nested there, finding an abundance of food in the shape of berries and grubs. Parts of Siberia, like Canada, had very genial spring and summer seasons, when everything grew quickly. He and his friend experienced weeks of perpetual light, and clouds of mosquitoes. Siberia, in addition to having the largest swamp in the world, had the largest plain and the largest pine forest, the latter extending for thousands of miles, and running through it were grand rivers teeming with salmon. The coasts and rivers were rich in fishing grounds. The country contained many plants and flowers never seen in the Southern Hemisphere, pictures of several of which were thrown on the screen. There was a good prospect for the country for settlement by political exiles from Russia; these were mostly superior people. Siberia teemed with birds, flowers, and mosquitoes.

MAY 11, 1908.

The monthly General Meeting of the Society was held at the Museum on Monday evening, May 11, 1908.

Mr. T. Stephens, M.A., F.G.S., in the chair.

Messrs. W. N. Atkins, L. A. Evans, O. P. Law, and L. Rodway were elected Fellows, and Mr. A. Conlon Associate of the Society.

THE FOLLOWING PAPER WAS READ :—

Notes on a Chipped Boulder from near Kempton. By Fritz Noetling, M.A., Ph.D.

The author described the boulder as one that had been chipped by the aborigines in getting their cutting implements from it. He found around it the principal flakes belonging to the stone. The place where the stone was found was the site of an old aboriginal camping ground on the slope of a hill on the northern side of Kempton. He described how the flakes were used as implements, and how they were struck off the core. The specimen was unique for Tasmania. It was a piece

of water-worn pebble stone, and must have been carried for a considerable distance to the camping ground for the manufacture of the cutting instruments of stone.

Mr. R. M. Johnston said the specimen Dr. Noetling had exhibited to them that evening was one of the most interesting that had been found in Tasmania. Eleven of the chips fitted beautifully on the core. Often pieces of rock chipped off from great changes of temperature, such as during bush fires, but he believed that these pieces were chipped off the core before them by aboriginals.

Mr. A. J. Taylor said he did not think the fragments were flaked off by fire, for fire would only cause fractures from the ouside, and this core had some fractures from the inside.

The Chairman said that fire would have broken off the flakes more from the outside. A rich field for Dr. Noetling's investigations would be found near the head of the Macquarie River, where the aborigines had a favourite camping ground near the outcrop of a cherty rock, which formed the material of most of their implements. He called attention to some flint and obsidian arrow heads which he had collected in Texas, U.S.A., some years ago, as illustrating a different phase of civilisation.

NOTES AND EXHIBITS.

Mr. R. M. Johnston exhibited a small specimen of a mountain trout (Galaxias truttaceus), captured by Mr. Tute at the Great Lake, which had an abnormal development in the shape of two mouths, being a sport or freak of nature; from the mouth, below the chin of the creature, the tongue protruded. A similar curiosity had been noticed by him some years ago in a sea perch.

Mr. A. J. Taylor made some remarks on the so-called bulrush caterpillar (Sphaeria robertsia). He said the caterpillar is interesting, because of the peculiar way in which it becomes the host of a vegetable form of life, which uses up the animal structure of the caterpillar for its own nourishment, while at the same time it replaces every portion so robbed with vegetable tissue to an equal extent. In this way the caterpillar is by degrees converted entirely into a vegetable root, exactly resembling, in every respect, the original form of the insect from which it had derived sustenance during its period of growth. The process of vegetation is this: Whilst burrowing in the light vegetable soil, previous to undergoing the process of its natural metamorphosis, the caterpillar gets some of the seeds of the fungus under the scales about its neck; and from this part of its body a seed vegetates, and grows into a single stalk, from six to ten inches high, the top portion of the stalk in the female plant, when fruiting, representing, only in a much smaller degree, the club-headed bulrush with which we are all so familiar. The body of the caterpillar is, as already described, gradually metamorphosed into the vegetable root of the plant. The seed vessel is the only portion of this curious plant found above ground, therefore it may be easily overlooked. When freshly dug up the root is soft, and, in spite of its woody

structure, may be found to contain satisfactory evidence—such as the intestinal canal—of its animal origin. The bulrush caterpillar is to be found in New Zealand and Tasmania. Other insects that suffer the same fate are known of; but none of these afford a more interesting illustration of the process by which Nature sometimes makes an apparently retrograde step—by descending from a higher, or insect, form of life to that of a lower or vegetable condition—than we find in the case of the bulrush caterpillar. He referred to samples of the bulrush caterpillar in fruit and sections indicating the woody structure of the insect after passing through the changes described.

The Chairman and Mr. Johnston corroborated the description of the development of this interesting parasitic fungus, the former remarking that its modern generic name was Cordyceps, and exhibiting a very perfect specimen of C. Gunnii, found at Franklin Village, near Launceston.

Dr. Noetling exhibited two minerals found by him at Gad's Hill and at Barn Bluff—viz., analcime and actinolite—the former being a species of zeolite heretofore found only near Port Cygnet.

JUNE 16, 1908.

The Monthly General Meeting of the Society was held at the Museum on Tuesday evening, June 16, 1908.

Sir John Dodds, K.C.M.G., Lieutenant-Governor, in the chair.

Messrs. L. F. S. Hore, B.A., Leonard Seal, and Joseph Love, M.B., were elected Fellows of the Society.

THE FOLLOWING PAPER WAS READ:—

On State Borrowing and Sinking Funds for the Redemption of State Debts regarded from an Economical Point of View. By R. M. Johnston, I.S.O., F.L.S.

In the first part of his paper, relating to state borrowing, the author points out—(1) the unprecedented progress of all civilised countries, especially within the last forty years; (2) that this progress entirely altered the methods and instruments formerly employed in the industrial world; (3) that the introduction of the improved machinery and instruments of transport and production involved immediate, enormous, and original outlay of capital; (4) that the consequent reduction in cost of production and transport, and of prices, so affected all parts of the world that new and old countries alike were, perforce, obliged to largely invest fresh capital for such purposes; (5) that great undertakings (such as the building of the great Canadian and Pacific Railway system), could not, practically, be constructed in a piecemeal fashion, over a period of from forty to sixty years, to accommodate the burden of the

payment of the principal required immediately, and, consequently, this impracticability, and also the necessity of securing a just and equitable share of burden to all who in the future derive benefit from the original outlay, the method of only charging interest on capital to each year's current revenue has invariably been adopted in all civilised countries. He illustrated, by reference to the United Kingdom, how capital investments were developed. That Australia, latterly, has not been investing capital in this direction, either absolutely or relatively to population, at as great a rate as the United Kingdom was indicated by the fact that during the last five years invested capital of the kind referred to in the United Kingdom represented a sum of 62s. 6d. per head per year; while in Australian States, in a country nearly as large as Europe, and as yet scarcely begun to be developed, the corresponding capital investments only represented a sum of 28s. 10d. per head per year. Would the present population, with its relatively high "standard of living" and its vastly increased wealth, have existed had the "retrenchment-and-ruin" cry of the year 1870 succeeded in forcing upon the states, at the time, the retrograde advice, "no borrowing" and "retrenchment." This, though eminently prudent, from the standpoint of a private individual, might still be open to question or qualification, when applied to the economics of a corporate body. He was of opinion that the state taxpayers of the day stand, in relation to the ever-changing individuality of the state taxpayers of the past and future, in exactly the same ethical and economical relation to each other, as do the existing shareholders of a private railway corporation to past and future shareholders of the same concern; and, consequently, there is neither moral nor economical grounds why either taxpayers of the state or railway shareholders of the day should, in addition to their own equitable share of burden, mulct themselves in additional heavy taxation or expense (as by sinking fund contributions) for the purpose of lessening the fair and equitable share of burden of their future personally disconnected representatives.

The author of the paper, in conclusion, affirms as his strong opinion that sinking funds for the absolute redemption of loans invested in railways, harbours, and other great public works, should be restricted to the portion of such loans whose assets are short-lived, and, like the short terminable life of marine vessels, cannot be permanently preserved in their pristine value and utility by the ordinary yearly contributions from current revenue funds to maintenance, renewals, and repairs, by which means the whole permanent way, machinery, and other equipments of railways are ever kept up to their pristine value and utility as bona-fide state assets.

Mr. T. Stephens said that the Fellows of the Society must congratulate themselves that, although Mr. Johnston had been away on a visit to the old country, he had returned to them with no loss of that force with which he had many times previously interested them. The subject upon which he had addressed them that night was such a big one that it would be well to postpone the discsusion upon it in order that the Fellows might have an opportunity of seeing it in print.

Mr. James Macfarlane also wished to have an opportunity of studying the paper in print before discussing it.

After further discussion, it was decided that the paper should be taken into consideration on a date to be fixed by the Council of the Society.

NOTES AND EXHIBITS.

Mr. Henry Baker gave an account of his recent visit to the Furneaux Group to study the habits of the mutton-bird. He found when he reached the islands that the birds had left about ten days previously. There appeared to be a tendency on the part of the birds to leave a little sooner every year. This was probably due to the encroachment of sheep and cattle on the rookeries, and the vast amount of egging which went on. The Government had imposed regulations, but they did not appear to be stringent enough. He had been told that the number of young birds that escaped was much less than it used to be. Next to mutton-birding, kangarooing was the most habitual occupation of the islanders. These animals had practically disappeared from all the smaller islands, and were becoming scarce on the larger ones. Three thousand a year would be a low estimate of the number that were killed. The kangaroo were hunted by dogs, which were kept half-starved to render them savage. It seemed a pity that so many kangaroo should be killed, considering the small price the skins brought. They were an important source of meat supply to the islanders, and if the close season were strictly enforced they would be subjected to considerable suffering. It was necessary, however, that the indiscriminate destruction that went on at present should be checked. He thought it was a great pity that the islanders could not be induced to take up some other forms of earning a livelihood than those they followed at present. If the people of Tasmania would interest themselves a little bit more in the islands their future would be brighter.

Mr. R. M. Johnston said he had visited the islands in 1874, and related some of his experiences. He agreed in the necessity for the preservation of native birds and animals, and hoped that Mr. Baker's reference to the matter would result in good.

Mr. T. Stephens thought the matter ought not to be allowed to rest. He suggested that the Council of the Society should address a letter to the Government, asking them to cause inquiry to be made as to the extent to which the existing regulations were carried out, and as to the wholesale destruction of kangaroo and wallaby. He moved a resolution to that effect, which was carried.

JULY 13, 1908.

The Monthly General Meeting of the Society was held at the Museum on Monday evening, July 13, 1908.

Sir John Dodds, K.C.M.G., Lieutenant-Governor, in the chair.

THE FOLLOWING PAPER WAS READ:—

On a recent visit to the River Gordon, illustrated by lantern slides, with remarks on the need of reservation of land along the banks of the River. By J. W. Beattie.

The visit was made in the middle of April last, eight days being spent in exploring the River Gordon. Unfortunately, for six days the weather was very wet, less than two days being available for the photographic work of the trip. Photographs of Macquarie Harbour Heads were displayed, showing the dispositions of the various harbour works. The outer and inner islands, and their lights, the breakwater, and the wreck of the s.s. Kawatiri, were shown, and gave a clear idea of the character of this wild western port of Tasmania, the "open door" of the West Coast mineral fields. The late Mr. Napier Bell's scheme for the removal of the bar was referred to, and another scheme, with a similar objective, but antedating Mr. Bell's by some seventy years, was mentioned. This early scheme, however, appears to have never gone beyond the presentation of a report by the originator—Captain James Hobbs—to the then Governor, Colonel George Arthur, in 1824. The discovery of Macquarie Harbour by Captain James Kelly was dealt with. Illustrations of the Port of Strahan were given, and also a fine series portraying the beautiful natural reserve of 70 acres called "The People's Park." These serve to emphasise the value of the forethought of the Strahan residents in obtaining one of a series of what have been aptly termed Natural Monuments, which will remain an abiding type of the indigenous flora. The historic places en route to the River Gordon were next dealt with—Phillip Island, Sarah Island, etc., being historically treated, and the beautiful and impressive mountain backgrounds overlooking the entrance to the river fully described, with some of the historical associations attached to them. The grandeur of the different reaches and bends of the Gordon was well illustrated, and served to emphasise the unique beauty of the river, and the urgent claims for its protection from the ruthless hand of present-day utilitarianism. The scenery at Gould's Landing, the various rapids in the upper reaches of the river, the River Franklin, and the scenery at the Great Bend, 65 miles from Macquarie Harbour, were well represented, the characteristics of the river being minutely described where illustration was not available. A brief sketch of the pine industry in the vicinity of the Gordon was accompanied by several illustrations of pine forests and logging.

In conclusion, the author urged most strongly that immediate and vigorous action be taken to thoroughly protect the banks of the River Gordon from Macquarie Harbour to a mile beyond the Franklin, a total distance of 26 miles, the area of reservation to extend to the line of hills running on either side of the river from the water's edge to at least one chain beyond their summits. On level river flats, where no hills

obtain, five chains from the river to be reserved. These reservations, in the opinion of the writer, should effectually prevent the destruction of the beautiful foliage, and retain not only an aesthetic asset of unique character, but an asset of great value from the tourist standpoint, which, if protected from the axe and fire, will undoubtedly become of great monetary value to the state.

Dr Noetling said that there was the finest scenery on the Gordon that he had ever seen in his life, and it would be a great pity if the insatiable timber merchant was allowed to destroy it. It was the duty of the Government to try and preserve that scenery and he favoured the land on each side being reserved up to the tops of the hills.

Mr. R. M. Johnston said that no one had done so much to make the scenery of Tasmania known as Mr. Beattie. It was due to his hard work and careful selection of subjects that the world knew so much of the beauties of Tasmania. They were all very much indebted to Mr. Beattie for the work he had done, not only in making the beauties of our state known, but in the patient and careful researches he had made into its old history.

Dr. Noetling said that if it was a fact that the Gordon ran for two miles under the Wilmot Range, as had been reported to Mr. Beattie, it would be the most extraordinary geological wonder in the world.

The Chairman said that he fully endorsed all that Mr. Beattie had said in regard to the necessity for the preservation of the scenery on the beautiful Gordon River, and he sincerely recommended everyone who had not had the privilege of visiting that part of the country to do so as soon as possible. The time would come when the West Coast would prove most attractive from a tourist point of view; and it therefore behoved the Government to preserve, as far as they could, these beautiful scenes from destruction.

Mr Beattie said that he had had that day received a telegram from Mr. Robert Sticht, manager of the Mount Lyell mine, supporting all that he had said in regard to the necessity of preserving the scenery along the Gordon, and stating that the present reservation made by the Government was inadequate. Nothing less than the whole range visible to the eye should be reserved. The interests of the pine-getters were paltry compared with the preservation of natural scenery.

NOTES AND EXHIBITS.

Mr R. M. Johnston exhibited some specimens of timber which had been treated with Captain M'Fie's white-ant specific, and pointed out that it not only preserved the wood from the attacks of insects and fungi, but enabled it to take a beautiful polish.

AUGUST 10, 1908.

The General Monthly Meeting of the Society was held at the Museum on Monday evening, August 10, 1908.

Mr. T. Stephens, M.A., F.G.S., in the chair.

THE FOLLOWING PAPERS WERE READ :—

(1) On the Native Quarry at Syndal, near Ross. By Fritz Noetling, M.A., Ph.D.

The author first mentioned a reported aboriginal quarry at Stocker's Bottom, near Ross. Some thought it was a myth, and so he found it; but on further exploration he found such a quarry at Syndal. Hundreds of thousands of fragments that had passed through the hands of aboriginals were found lying about. He exhibited specimens. From this quarry stone for the implements used by the aboriginals was obtained. A vast amount of time and labour must have been spent in vain by the aboriginals whilst shaping their implements, and in connection with these operations they used fire. The other quarries of this character in Tasmania, the lecturer said, were at Cole Hill, near Melton-Mowbray; a small one near the railway station, Pontville; one at Shene Estate; at Charlie's Hope, Plenty; the Great Lake; on the road from Campbell Town to Swansea; on the South Esk, near Perth; at Pipeclay Lagoon; on the Tamar River; and on Mount Communication, near Saltwater River. Most of these might, at any rate, be considered as native quarries. He referred to the flints discovered in the tertiary formation at Thenay, in France, as to the origin of which there had been much controversy.

Mr. R. M. Johnston spoke of the kinds of rock from which the aboriginals formed their stone implements and weapons. Among the natives of West Australia to-day there were to be found the same primitive stone implements as were found after the Tasmanian aborigines had disappeared; the West Australian natives preserved their ancient chip flints for sacred rites purposes.

(2) On a Native Burial Ground at Charlton, near Ross. By Fritz Noetling, M.A., Ph.D.

The author remarked that Ling Roth's book on the aborigines of Tasmania had fully dealt with the character of these burial places. The one under notice had been very carefully examined. It seemed certain that the natives on this island burnt their dead, but differences of opinion arose as to their disposal of the ashes. It was pretty certain that they used to smear their faces with the ashes. Some were said to have put dead bodies in hollow trees, fencing them round with bushes. They knew that the names of deceased persons were never mentioned again, as the race were very superstitious about the departed. He believed there were regular aboriginal burial grounds, and his discovery on the Charlton Estate seemed to settle the question. There were heaped up a number of little mounds, in which large stones were embedded. There were no

bones to be found. The Charlton burial ground must be of great age. It was a question whether the corpses were carried to the burial ground and burned there, or whether the ashes of the departed were subsequently carried to the burial ground. He favoured the latter idea, a pyre having been erected and a body cremated at the spot where death took place. It would be interesting to know whether other similar burial grounds existed in Tasmania. He was told that there was one at Pontville, and another at Darlington Park.

Mr. A. J. Taylor described a burial place of probably a Tasmanian aboriginal warrior. He quoted Backhouse's and Robinson's descriptions of the incinerating process which was resorted to. The natives were very jealous of Europeans witnessing their burial ceremonies.

Mr. Bernard Shaw said the late Mr. Jno. Lyne used to mention a case under his own observation of the burial of a native in a hollow tree, but the body was afterwards removed.

Mr. Henry Foster remarked on the very few skulls of natives having been found, which was, no doubt, due to their generally burning their dead.

SEPTEMBER 14, 1908.

The Monthly General Meeting of the Society was held at the Museum on Wednesday evening, September 14, 1908.

Mr. T. Stephens, M.A., F.G.S., in the chair.

THE FOLLOWING PAPERS WERE READ :—

(1) Additions to the Tasmanian Molluscan Fauna. By W. L. May.

This paper, a portion of which was read by the Secretary to the Council, is of a technical character, and describes the results of dredging near the 100-fathom line off the south coast of Tasmania.

Mr. R. M. Johnston referred to the two species mentioned by Mr. May as belonging to a family of fissure-grooved shells of very ancient origin.

(2) On Solar Eclipses, illustrated by lantern slides. By H. C. Kingsmill, M.A.

The author referred to the total eclipse of the sun, to take place on May 9, 1910, and the proposed visit of an English expedition to observe it in Tasmania. Owing to the rarity of solar eclipses, expeditions have generally to be made to distant countries by those who require to investigate the phenomena of eclipses. It happens that Tasmania is the only land in the world from which the total phase of that eclipse will be observable, if we except the icy regions near the South Pole. The central line of the eclipse would pass a little to the south

of Tasmania, whilst the northern edge of the totality would hardly extend to Launceston. Tasmania would have, therefore, on the occasion a unique importance in the eyes of astronomers, who would be attracted from distant parts of the world. There had been one astronomical expedition to Tasmania which led to important results, namely, the American expedition for observing the transit of Venus in 1874. The object of that expedition was to obtain data for a more accurate determination of the distance of the sun from the earth, which is the largest base line we have for astronomical measurements. Incidental to that expedition was the accurate determination of the latitude and longitude of a station in the Hobart Barracks, which was done by means of simultaneous observations taken at the Melbourne Observatory and by the American astronomers at Hobart. The Agent-General had forwarded letters from General Tennant asking for information as to eligible sites for the observation of the eclipse. Mr. Kingsmill explained and illustrated by lantern slides total eclipses of the sun with the corona in each case extending far beyond the sun as obscured by the moon. But for this a total eclipse would mean for the time being absolute and total darkness. It was found that when a profuse crop of sun spots showed the sun to be in exuberant activity, the action of this exceptional excitement produced a corresponding influence on the magnetic state of the earth. There was a large and valuable body of evidence available to demonstrate that there did exist some sympathy between periods of solar agitation and periods of excited terrestrial magnetism.

The Chairman thought there were three places which stood out as eligible for the purposes Mr. Kingsmill had mentioned: 1. Near lighthouse on Bruni Head (South Bruni), 335ft. above high-water mark. Access from Great Taylor's Bay. 2. Southport Bluff, nearly opposite lighthouse. Access from a jetty on the south side of Southport, with deep water near at hand, and good anchorage; thence two or three miles' cartage to the Bluff. Depth of water at the entrance to Southport, 10 to 17 fathoms. 3. Between Point Arthur and second look-out on south side of Recherche Bay, and about six miles south of Southport Bluff. Entrance to Recherche Bay has depth of from 8 to 16 fathoms, with good anchorage inside.

Mr. R. M. Johnston referred to the importance of the expedition to Tasmania, and hoped institutions on the mainland would join in the reception of such an important body of visitors.

Dr. Noetling enlarged on the grandeur of the total eclipse of the sun, which he had witnessed in India, and said that scientists were very keen on observations at such a time to try to discover another planet believed to exist nearer to the sun than the planet Mercury. At the forthcoming observations in Tasmania he feared the sun would be rather low down in the heavens at the hour at which the total eclipse would take place, namely, 4 p.m. Would not the top of Mount Wellington be the most suitable situation for the observations?

Mr. Piesse thought that the South Bruni site was the best of those mentioned by Mr. Stephens. Maatsuyker Island or Port Davey might be suitable if helpers could be got, as the farther west the better. He also mentioned positions near Daniel's Bay and Mill's Reef. He was doubtful whether any real advantage would be gained in going south of Hobart. Mount Rumney would be an excellent situation, he thought. Mount Wellington was apt to be cloudy in the afternoon, whilst Mount Rumney was not so.

Mr. Bernard Shaw moved the following resolution:—"That in connection with the proposed expedition to observe the total eclipse of the sun on May 9, 1910, a letter be addressed to the Premier urging the necessity for a careful examination by an observer acquainted with astronomical requirements of sites which appear most likely to be suitable for the purposes of the expedition and the collection of information on the following points:—Climate; protection required for the instruments and observers at the chosen station; amount of cloud and rainfall; liability to fogs; accessibility for members of the expedition, and for any other purpose; natural harbour accommodation; facilities for obtaining material and labour for erection of temporary buildings, and facilities for commissariat."

Mr. R. M. Johnston seconded the motion, which was carried.

OCTOBER 12, 1908.

The Monthly General Meeting of the Society was held at the Museum on Monday evening, October 12, 1908.

Mr. T. Stephens, M.A., F.G.S., in the chair.

Messrs. E. J. Roberts, M.B., B.S., and Leonard E. Hubbard were elected Fellows of the Society.

THE FOLLOWING PAPERS WERE READ :—

(1) The Aboriginal Designations for Stone Implements. By Fritz Noetling, M.A., Ph.D.

The author points out in great detail that the vocabulary of the aborigines was very limited in extent. Calder, whose compilation was probably the most comprehensive, enumerated only 1135 words, some of which were unquestionably adapted from European sources. The results of his investigation tended to show that the aborigines did not have different names for the different kinds of stone implements they used. He thought he had proved that the Tasmanian natives only had one word for their stone implements.

(2) On the conclusions of Dr. Noetling respecting the Aboriginal Designations for Stone Implements. By Hermann B. Ritz, M.A.

Further particulars of the subject are given in the paper. The author remarks that the records were very meagre, and that these were made by men who had no special knowledge of philology. The number of words in the aboriginal language was small, much smaller than the lists which had been drawn up would lead one to expect. Many of the words, apparently different, he believed to be really identical, and the apparent difference was due to the habit the Tasmanians possessed, in common with the South Sea Islanders, of interchanging members of various sound groups.

Mr. R. M. Johnston said their attention hitherto had been confined to the things themselves, instead of to the language applied to them. Both the Tasmanian and Australian races would afford a great field in the future to the philological student, and Dr. Noetling had opened up a question that would be pursued with great interest. It was the beginning of a very important study in connection with the aborigines. He pointed out that already an important work had been performed in getting phonographic records of some of the old aboriginal songs and speeches by the late Mrs. Fanny Smith. He hoped that permanent casts of these records would be made, so that they could be preserved indefinitely.

Dr. Noetling thought that Mr. R. M. Johnston's suggestion that the records of Mrs. Fanny Smith's songs and speeches should be preserved, was a most excellent one.

Mr. Bernard Shaw said that he would bring the question of getting permanent copies of the Fanny Smith records before the Council.

The Chairman said it was a matter of regret that so little was really known of the early history of the Tasmanian natives. No attempt had been made to record their language until it had become to some extent corrupted by contact with Europeans and others.

NOVEMBER 16, 1908.

The Monthly General Meeting of the Society was held at the Museum on Monday evening, November 16, 1908.

His Excellency the Governor, Sir Gerald Strickland, K.C.M.G., President, in the chair.

Mr. Bernard Shaw offered the President the hearty congratulations of the Royal Society on his safe return to Tasmania. He had received numerous congratulations from various public bodies since his return, but none more heartily joined in them than the Fellows and Associates of the Royal Society.

The President, in reply, thanked the Fellows present very heartily for their kind welcome, which reminded him of the welcome extended to him by Mr. Morton upon his arrival at

Colombo, when first on his way to Tasmania. He had then telegraphed to assure them of the interest he would always take in the proceedings of this Society, and he could further assure them that this interest would continue as long as he had the honour to serve His Majesty as his representative in Tasmania.

The Rev. E. H. Thompson, the Rev. A. H. Mitchell, and Lieut.-Colonel E. T. Watchorn were elected Fellows of the Society.

REPORT.

The report of a Committee appointed to consider the question of a possible reduction in the rate of subscription of Fellows was read by the Secretary to the Council. In this report the Committee trace the history of the Royal Society for the past sixty years as gathered from the records in the Library. In 1848 the number of members was 123, and the subscription £1 per annum. In 1853 the number of members was 236, with a corresponding increase in the amount of subscriptions paid. In 1854 the subscription was raised to £1 10s. per annum, and this at first considerably increased the income of the Society, but in the suceeding years the records show a gradual falling off, until in 1861 the number of members, now called Fellows, is reduced to 106, the amount realised being £159 10s. In this year, at the Annual Meeting, a motion is submitted for a return to the original rate of subscription, but this is negatived by the casting vote of the Chairman. The report traces in detail the gradual declension in the next twenty years, the minimum being reached in 1880, when the number of Fellows was 68, and the income from subscriptions £102. The subsequent records of number of Fellows and amount of subscriptions were too incomplete to enable the Committee to trace the financial history of the Society in detail, but the tables recently compiled by the Honorary Treasurer give the receipts and expenditure for the four years from 1904 to 1907. They came to the conclusion that the main cause of diminished membership and income was the increase of the subscription in 1854. The Committee report the receipt of remarks and suggestions from Fellows resident in Launceston and its vicinity, who point out that all they get in return for their subscriptions is the publication of volumes of the Proceedings of the Society at uncertain intervals, and that the long delay in the publication of original papers places all authors at a serious disadvantage. They would favour a general reduction in the amount of the annual subscription as soon as it could be safely done, and an immediate reduction in the case of country members. They also suggest that balance-sheets of receipts and expenditure should be published in an improved form, and that the get-up of the annual volumes should be greatly improved; but these suggestions had been anticipated by the Council, and are already taking effect.

The report concludes with the following recommendations:—

1. That the rate of subscription for all Fellows resident beyond a radius of 15 miles from Hobart be reduced from £1 10s. to £1 per annum.

2. That the utmost economy be observed in regulating the expenditure already authorised, and that no additional expenses be incurred without the sanction of the Society.

3. That any balance available out of the income of the current year be expended on the binding of the Library set of annual volumes for the last nine years, on the binding of other important publications now useless for purposes of reference, and on the purchase of recent works in various branches of science, so far as may be found practicable.

4. That Fellows be requested to use every effort to so far increase the membership of the Society as to make it possible to effect a general reduction in the rate of the annual subscription at the end of 1909.

Mr. T. Stephens, as Chairman of the Committee, moved the adoption of the Report, to give Fellows present an opportunity of expressing their opinions on the recommendations.

Mr. R. M. Johnston thought that original papers read should see the light of day as early as possible. He would like to have an opportunity of looking into the report at his leisure, and for that reason moved that it be laid on the table. The motion was seconded by Mr. Brettingham Moore, but was subsequently withdrawn.

Mr. Stephens said that the Council had now made ample provision for the publication of original papers, and no such trouble as had occurred in the past. was likely to happen again.

The President said that the immediate question before the meeting was whether the Fellows and others interested in the Society should be given an opportunity of carefully considering the report and arriving at a decision thereon after deliberation. So far as he was concerned it would give him pleasure to be present at a special meeting at which this report might be fully considered. It was, no doubt, a very important decision that the Society was asked to give, and should, if possible, be unanimous. This Society had survived for two, and very nearly three generations. That was a great record for things Australian. It fulfilled a real need in the community, by offering a non-political, non-sectarian, and genuinely scientific centre where original thought could find a sympathetic atmosphere. They could not expect that original thought would be forthcoming with the regularity of blackberries in autumn, and there must be ups and downs in the volume of interest, both as regards the readers of scientific papers and those who wished to listen to them. It should be their object not only to keep the Society alive, but to keep it alive in accordance with the spirit and needs and claims of the times. The amount of subscription was certainly a factor in that co-ordination, and he observed

with great pleasure that the financial tone of the report now before them was on a plain and satisfactory basis as to the difficulties that were referred to when they last met to discuss financial questions. The position was very clear, and, he would venture to say, more hopeful. Although the annual income was very small, the difference between it and the annual expenditure was a negligible quantity. Although there was no reserve fund, they had not to deplore any funded or floating debt, and they might refer with satisfaction to their assets, which consisted not merely of the library, and the position they held in having the right to use these premises, but also in the good will and position which the Society enjoyed. It was merely a question of using these valuable assets to the best advantage.

The first recommendation was put to the vote:—"That the rate of subscription for all Fellows residing beyond a radius of 15 miles from Hobart be reduced to £1 per annum."

Mr. Bernard Shaw said that the Council of the Society was exercising the strictest economy. As Treasurer, he was able to express a hope that at the end of the year they would not find their accounts overdrawn.

Dr. Noetling said there were so few members outside the 15 miles radius that the total loss by the reduction proposed would not be more than £8. It was felt that if the subscription was reduced to £1 the probability was that the number of non-resident members would be largely increased.

Mr. Lyndhurst Giblin said that no previous notice had been given of a recommendation which proposed an alteration in one of the Rules of the Society. Was it competent for the meeting to agree to such a proposal without the previous notice prescribed by these Rules?

The President ruled that the objection was fatal, and, after discussion, the consideration of the report was deferred to a special meeting to be held on Wednesday, November 25.

THE FOLLOWING PAPER WAS READ:—

An Introduction to the study of the Aboriginal Speech of Tasmania. By Hermann B. Ritz, M.A.

The author says that the life of a population invariably assumed a form which largely depended on the climate and geographical features and the facility of intercourse with the denizens of other lands. To the observing ear of the scientist the remnants of the feasts of the aborigines, their implements, and the scanty records of their words and doings spoke in a language of their own of those whose places we had taken for good or ill. It was to the words, the records of the actual songs of the voice that was still, that he would confine their attention, and their present purpose was to clear the ground and mark out the foundation for constructing a scientific reproduction of the language of the aborigines of Tasmania. As far as he was aware, the work done in that direction had not hitherto

been extensive. After stating his attempt to simplify the spelling, Mr. Ritz compared three versions of an aboriginal song, accounting for every word, and explaining the meaning of the sentences. He said there was no sign of any accidence. The words seemed invariable in form and widely applicable in meaning. The words were probably supplemented by gestures to define their exact meaning. In that respect a parallel was found in the sentences of the Chinese language. The fact that the song existed in different dialects made it most valuable. Quite probably the song was connected with some important tribal ceremonies.

The President asked if the half-castes on the Straits Islands retained any traces of the native language.

Mr. Ritz said that it was scarcely possible. Constant intercourse with the whites would cause them to neglect their own tongue, except as far as they wished to keep it for secret conversations.

Dr. Noetling and Mr. R. M. Johnston spoke in high terms of the value of the researches of Mr. Ritz, and hoped he would continue his studies.

NOTES AND EXHIBITS.

Mr. W. L. May presented to the Society a number of new species of shells, dredged by himself and Mr. Hedley from a depth of 100 fathoms off Cape Pillar. There were 80 species in all, many of which had been found at a depth of 100 fathoms off Sydney, and at a similar depth off the coast of South Australia. Amongst them were specimens of Pteropods, free swimming organisms, which lived on the surface, but whose shells fell to the bottom when they died.

Mr. R. M. Johnston said that Messrs. May and Hedley had performed a very notable feat in presenting to the Society one-eighth of its molluscan fauna at one time.

NOVEMBER 25, 1908.

A Special General Meeting of the Society was held at the Museum on Wednesday evening, November 25, 1908, for the purpose of considering a proposed modification of Rule 16, and for other business.

His Excellency Sir Gerald Strickland, K.C.M.G., President, in the chair.

Mr. T. Stephens said that a Committee had been appointed to consider the question of reducing the annual subscription, and other matters, and had brought up the following recommendations:—

1. That the rate of subscription for all Fellows resident beyond a radius of 15 miles from Hobart be reduced from £1 10s. to £1 per annum.

2. That the utmost economy be observed in regulating the expenditure already authorised, and that no additional expenses be incurred without the sanction of the Society.

3. That any balance available out of the income of the current year be expended on the binding of library set of annual volumes for the last nine years, on the binding of other important publications now useless for the purposes of reference, and on the purchase of recent works in various branches of science, so far as may be found practicable.

4. That Fellows be requested to use every effort to so far increase the membership of the Society as to make it possible to effect a general reduction in the rate of annual subscription at the end of 1909.

He moved that the recommendations of the Committee be adopted.

Mr. Bernard Shaw seconded the motion, which was agreed to.

Mr. R. M. Johnston said that the Fellows of the Society were indebted to His Excellency the Governor for giving up his time, which was so much taxed in every way, to attend the meeting. He wished His Excellency and the Lady Edeline Strickland and family a Merry Christmas and a Happy New Year.

His Excellency, in reply, said that it was always a great pleasure to him to attend the meetings of the Society, and he wished it continued prosperity and renewed vigour.

NOTES ON A CHIPPED BOULDER FOUND NEAR KEMPTON. (PL. I. AND PL. II.)

By Fritz Noetling, M.A., Ph.D., etc.

(Read May 11th, 1908.)

It has rather been a problem whence the Tasmanian Aborigines obtained the material for their implements. The discovery of certain localities where the rock suitable for implements occurred in situ, and which were unquestionably worked by the Aborigines, has partly solved the problem. It is unquestionable that the Aborigines obtained a certain amount of the raw material from these so-called quarries, but it is equally certain that a large portion was obtained from different sources.

One of the best-known "native quarries" is that situated on Coal Hill, near Melton-Mowbray. A careful statistic of the specimens collected by me around Melton-Mowbray gave the following results:—

Cherts of all kinds	80.7	per cent.
Chert from the quarry	6.1	,,
Porcellanites.	7.3	,,
Breccia	0.7	,,
Others not included under the above headings.	5.1	,,

The above figures conclusively prove that, though the quarry on Coal Hill was conveniently situated and easily reached from the camping grounds near the river, only 6.1 per cent. of the implements found were derived from it. Far the larger portion, that is to say 93.9 per cent. of the implements, were made from rocks which came from other places besides the quarry on Coal Hill. A priori one would assume that, with such a convenient place as the quarry on Coal Hill close at hand, the overwhelming majority of the implements would be manufactured from material obtained from

this place, but the above figures prove that it is not the case. I had already noticed this fact when collecting, but only after carefully sorting the specimens could I fully prove it.

Considering that the quarry on Coal Hill was so close to the camping grounds, and that, notwithstanding its situation 93.9 per cent. of the implements were made from a different kind of rock, we are forced to assume that the quality of the rock was the most essential feature when it was intended to produce an implement. Though unlimited quantities were available in the quarry on Coal Hill, the quality of this particular kind of chert was not such that it was highly treasured by the Aborigines as a suitable material for implements. They unquestionably preferred other kinds of cherts to that occurring on Coal Hill; but the question arises, whence did they procure the raw material, of which they consumed such large quantities in the manufacture of their implements?

From the study of the specimens I collected I had already come to the conclusion that the gravel deposits of the various creeks, but above all the gravel and conglomerate deposits of diluvial age, were the source from which suitable material was obtained. I noticed that numerous implements, usually of the less finished type, represent fragments of water-worn pebbles or boulders, the smooth, water-worn crust being still preserved. It is, however, not till a find I recently made on a camping ground north of Kempton that this view was fully confirmed.

This camping ground is situated on the eastern slope of a low hill which stands out prominently from the surrounding flat country. It is a considerable distance away from any present watercourse, and about 200 feet, I should say, above the level of the River Jordan. Here I found the water-worn pebble, which forms the subject of this paper. I first discovered the core, and, as my attention was drawn to some fragments lying close about it, which seemed to be of the same kind of rock, I collected a few, and tried to fit them to the core. They were failures, but after repeated attempts I succeeded in fitting one to its original position, and, encouraged by this, I hunted for more, and eventually succeeded in

finding sixteen fragments which could be refitted and placed in their original position before they were flaked off.

I thus succeeded in restoring the greater portion of the original boulder, and, though a good part is still missing, and will probably never be found, that which has been preserved is of the utmost interest.

As it presents itself now we can distinguish three different parts, two of which are preserved, while the third is missing, but its shape can easily be reconstructed. These parts are—

1. The core (Nucleus).

2. The spalls or fragments falling off when the pebble was worked.

3. The fragment used as an implement.

1. THE CORE.—This part measures about 7 x 5 x 4 inches, and weighs 5lbs. 10oz. at cap. It is somewhat irregularly oblong in shape, and the lower side in particular shows the surface of a well-worn water pebble. The upper side has been subjected to a good deal of work, and, if merely judged by the planes of fracture, at least seven flakes, one of which has not measured less than 4½ inches in length, have been struck off.

If nothing more were preserved than this specimen we could at once recognise it as a core—that is to say, the remains of a larger-sized pebble from which suitable pieces have been struck off, and which was rejected as being without further use. The size, the weight, and the absolutely unsuitable shape are entirely against the assumption that this specimen might perhaps have been actively used as an implement—a hammerstone, for instance. Even without the flakes being found, the even planes of fracture would prove conclusively that this specimen has been submitted to a passive and not too active treatment, in other words, that it is a Nucleus, which, after the desired object had been attained, was rejected.

The whole surface, including the planes of fracture, are covered with a thick patina of yellow-brown colour,

which is, however, somewhat lighter on the planes of fracture than on the original crust.

2. THE SPALLS.—I collected altogether 39 fragments, weighing 2lbs. 14½oz. in the aggregate, which apparently were struck off this core; and 34 could be replaced in their original position. It is very probable that the remaining 5 flakes belong to the same specimen, but too much is missing to permit them to be fitted together with the others. However that may be, the fact that 34 flakes, weighing 2lb. 12½oz., could again be replaced in their original position, is of the greatest interest.

The flakes vary, of course, in size and shape; but on the whole they are of a lamelliform character—that is to say, of comparatively small thickness. Most of them show a fine bulb of percussion, and it may be said that almost every one of them could have been used as an implement. I select only two—the largest and the smallest—for description. The largest measures 5 inches in length, and exhibits a fine, smooth pollical face; its general outline is somewhat triangular, the base broad, and pointed at the opposite end. The two lateral edges are sharp; the indical face shows a good deal of flaking; the smallest flake measures about 2¼ inches, and is of irregular circular shape; the edges are very sharp; the pollical face shows a fair bulb of percussion; the indical face is flat, but shows no traces of chipping. Weight, 8oz.

3. THE FRAGMENT WHICH WAS USED AS AN IMPLEMENT.—Unfortunately this is missing—in fact, it can hardly be expected that this were preserved, as it was evidently the desired object and in whose manufacture the pebble was broken. By refitting the fragments to their original place, the general outline of this missing fragment could, however, be obtained by filling up the empty space with plaster of Paris or any other suitable material. This showed that the flake, which was apparently desired for an implement, was of triangular shape, and rather thin. It measured about 4 inches by 2½, was broad at the base, and sharply pointed at the opposite end. The lateral

edges were sharp and cutting, the pollical face smooth, the indical face showing a median ridge (1).

One of the fragments is broken, and the fracture shows that the material is a dark black chert of very fine texture. The outward appearance of neither the core nor the flakes, which are covered with the same patina of light, yellowish-grey colour, would indicate that the actual colour of the rock is dark black. The comparative thickness of the crust of weathering proves, however, that the core and flakes must be of considerable age, because such a thick patina as exhibited by this specimen is not formed in a few years.

The specimen here described is unique for Tasmania, and we can only wonder at the chain of lucky circumstances that made its discovery possible. The find of the core, with a large number of spalls falling off during the manufacture of the desired object, all lying close around it, proves conclusively that the working took place exactly at the spot where it had been found. Nothing disturbed the core or the flakes since the day when they were struck off from a waterworn pebble, weighing probably not less than 10lb. Yet, as proved by the thickness of the patina, a considerable time must have elapsed since this pebble was broken. It would rather be rash to assume that the very last Aboriginal who visited this camping ground left core and spalls behind, perhaps in a hurried flight. On the

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(1) Since the above was written I re-visited the place where the above specimen was found. Not only did I succeed in finding 19 more flakes, 17 of which could be fitted to the core, but I actually succeeded in finding the missing flake, the object of breaking the pebble. This had been carried away about 50 paces to the north from the place where I found the nucleus and its fragments, and there it had been dropped. It is the exact counterpart of the cast, and I must confess that, had I not recognised the likeness with the cast I had made, I would have probably left the specimen behind. It appears, as it was surmised, that this piece was taken away to be used, but, as it was apparently not suitable, it was simply rejected, and the whole work of breaking this large pebble was in vain. The edges of this flake are broken, and it may perhaps have been used, but there is no marginal chipping, and the specimen was apparently rejected exactly as it was when it had been obtained after so much labour. This is perhaps the most interesting discovery of all, inasmuch as the missing specimen was traced and actually recognised from the cast, representing its likeness.

other hand, if we assume that core and flakes had been lying for any length of time at the place where they were found it would be surprising that they were not disturbed by later generations visiting this place. The only way to account for it is that soon after core and flakes had been produced the drifting sand covered it entirely, thus preserving it almost completely as it had been left. Only of late, when the sand had shifted, it was exposed again. Lucky it was that the plough had not gone over this spot, otherwise it would have been impossible to collect such a large number of fragments belonging to one and the same core.

A number of interesting facts and questions arise from the study of this specimen. Though not completely restored to its entire shape, we can state with absolute certainty that the original was a pebble or boulder, well worn and smooth all over its surface, of deep black colour, weighing not less than 10lb. As there are no gravel deposits or conglomerate anywhere near the place where it was found, it must have been picked up at a considerable distance, and been carried to the camping ground to be used for the manufacture of implements.

The Tasmanian Aborigines have been described as a lazy lot, and it is therefore hardly probable that the Aborigine who found this pretty heavy boulder carried is for a long distance to his camping ground unless he valued the material. If he valued the material it is surprising that he used so very little of it; the size of the core proves that it contains the greater portion of the bulk of the original pebble. The fragments prove that one, perhaps two, flakes have been turned into implements. That fragment which probably has been turned into an implement seems to differ very little from those that have been rejected. In fact, considering the very crude flakes that have often been used as implements, it is astonishing to find that the two specimens which have been here described, and which are distinguished by a fine smooth pollical face were not used as tools.

It is very difficult to find a suitable explanation. If the rock was of the valued kind, why is it that so much waste was left behind? If not, why should the lazy Aboriginal trouble to carry the heavy pebble for a long

distance from the place where he found it to his camp? Can it be possible that it was desired to produce nothing but an implement of a certain size and weight, and that all other flakes, however useful they may otherwise have been, were rejected till the desired object was obtained? If this be the case, and I can see no other satisfactory explanation derived from the evidence of the core and the rejected flakes, we have to consider all the archaeolithic implements used by the Aborigines as a produce of the moment, manufactured then and there for the purpose for which they were required, and, having served their end, to be rejected without being applied to further use. This would to a certain extent explain the rather astonishing number of archaeolithes we find on the camping grounds, some of which seem to be very serviceable still.

Roy. Soc. Tasm. 1908. Pl. 1.

Dr. Noetling, Photo.

CORE AND FLAKES, Kempton.

Dr Noetling, Photo

CORE AND FLAKES, Kempton.

STATE BORROWING, AND SINKING FUNDS FOR THE REDEMPTION OF STATE DEBTS, REGARDED FROM AN ECONOMICAL POINT OF VIEW.

By R. M. Johnston, I.S.O., F.S.S

(Read June 16th, 1908.)

PART I.—STATE BORROWING.

The success of young colonies, such as those of Australia, has, in a large measure been due to the sacrifices which the earlier pioneers made, from time to time, in making timely provision for the opening up of Australia's vast virgin lands, by means of roads, railways, bridges, jetties, harbours, etc., in advance of actual occupation or settlement.

To any thoughtful person it is obvious, at the initial stage of a colony's history, it would be impossible to construct such costly undertakings without the aid of foreign capital.

Since the year 1842 the six states of Australia have practically entered into partnership with foreign capitalists in this important work of providing railways, roads, bridges, harbours, in advance of further settlement, and in no other way would it be possible to have succeeded in making the outlay of £240,149,727, in a period of 64 years, or at the rate of £5,024,000 per annum.

The following is a brief statement showing how this large amount of borrowed capital was invested:—

HOW BORROWED CAPITAL WAS INVESTED BY THE STATES.

Invested in	Amount £.	Per Cent.
Railways and Tramways	141,271,521	58·83
Telegraphs	3,752,942	1·56
Roads, Bridges, Lights, Harbours, etc.	25 387,083	10·57
Water Supply and Sewerage	30,093,318	12·53
Defences	2,409,893	1·01
Other Public Works and Services	28 093,589	11·74
Unexpended balance	9,041,381	3·76
	£240,149,727	100

Has Australia benefited by this Borrowing of £240,149,727, or, what may be more properly termed—Taking into Partnership a Foreign Capitalist in a profitable undertaking?

The best answer to this query is to contrast the year 1870 with the year 1906-7, within which time the bulk of the Debt was contracted, as shown in the following table:—

PARTICULARS.	1870	1906–7.	INCREASE.	ANNUAL RATE.
Population	1,652,000	4,197,038	2,543,038	2·55
Ex-Australian Exports	£26 253,000	69,794 000	43,541,000	2·75
Sheep	41,639,000	83,798 893	42,159,893	1·96
Cattle	4,278,000	8,636,360	4,358,360	1 97
Railways—				
Miles Open	994	14 067	13,073	7·63
Invested Capital	£9,829,000	£140,707 404	130 878,404	7·63
Profit on Working per head	5s. 7d	30s. 1d	24s 6d.	
Interest on Debt per head	17s 2d.	41s 10d.	24s 8d.	
Taxation per head	47s. 8d.	66s. 7d.	18s. 11d.	
Taxation, less profit on Working of Railways	42s. 1d.	36s 6d.	5s. 7d.	
Public Debt	£28,328,000	£240,148,727	£211,820,727	6·11
Income of the People—				
Estimated Annual Value Mil. £'s.	72·32	193·90	121.58	2.77
Capital Value Mil. £'s.	2,066·28	5,540·08	3.473·80	2·77
Ditto after deducting the whole of Public Debt Mils. £'s.	2,037·95	5,299·93	3,267 91	2·70
Ex-Australian Trade—				
Total Imports and Exports Mils £'s.	36·09	114 52	78·43	3·26

A careful study of the contrast in the conditions of the Six States of the Commonwealth between the years 1870 and 1906-7, covering a period of 36 years in all, should convince all pessimistic observers that the past policy of entering into partnership with foreign capitalists to the extent of 240 million pounds, instead of being a mistake or a hindrance to Australia's financial and industrial development and progress, has been the principal means whereby our present conditions, con-

trasted with the former period, has in every way so markedly improved.

It may be of advantage to summarise some of the features which have led to this most satisfactory result:—

SUMMARY OF RESULTS.

POPULATION.—The population has increased from 1.65 millions to 4.19 millions, or 2.59 fold.

TOTAL EXTERNAL TRADE.—The total Imports and Exports (Ex-Australian) has increased from 36.09 million pounds to 114.52 million pounds, or 3.17 fold.

RAILWAYS:—

MILEAGE WORKING.—The miles open of Railways in the six States has increased from 994 miles to 14,067 miles, or 14.15 fold.

CAPITAL INVESTED.—The capital invested in construction and equipment of State Government lines has increased from 9.82 million pounds to 140.70 million pounds, or 7.63 fold.

PROFIT ON WORKING.—The profit on working all State Railways has increased from 5s. 7d. per head to 30s. 1d., or 5.39 fold.

INTEREST BURDEN ON STATE DEBTS.—The interest burden on all State debts increased from 17s. 3d. per head to 41s. 10d., or 2.43 fold.

INTEREST BURDEN ON ALL STATE DEBTS, LESS amount from profit on the working of State railways alone, increased from 11s. 7d. per head to 11s. 9d., or increase of 2d. per head.

Notwithstanding that Total Interest Burden on all State debts has increased by 24s. 8d. per head, such has been the increase in the profitable working of the State railways alone—viz., 24s. 6d. per head—that the total interest burden connected with the Total Debt of 240.14 million pounds has only been raised by 2d. per head. That is, the profits to the State Treasuries from working railways (apart from the immeasurable material benefit of opening up the lands by the cheap and rapid mode of transit and communication have already almost wholly wiped off the taxpayers' interest burden on the

whole of the accumulated unredeemed Debt of 240.14 million pounds.

The fundamental error in the views of certain critics, who lack expert knowledge of matters pertaining to the economics of State finance as applied to the Australian States, is the evident common failure to appreciate the scope of the functions of the general governments of the various States of Australia as compared with those of the United Kingdom, and fail to discern the important distinction between debts incurred for purposes of protection or aggressive warfare and capital investments (also bearing the name Public Debt) incurred and expended in improving and permanently enhancing the value of the Public estate by means of railways, roads, and harbours. In the self-governing States of Australia, the scope of general government—owing to the peculiar conditions of lands thinly populated with vast undeveloped areas—embraces many functions which, in the earlier stages of development, would be impossible to resign either to local bodies or to private enterprise as in the older more densely-populated countries.

Unless this fundamental distinction of the scope of the general government in old and new countries be thoroughly considered and allowed for, all comparisons relating to the proportion and Cost of Public Services and public debt between countries so differently conditioned would be worse than useless. In the United Kingdom the greater part of these services (70.89 per cent.) is left to private enterprise (railways) and to local government.

Only 29.11 per cent. of the Total Debt for all such purposes in the United Kingdom comes directly within the scope of the revenue and expenditure of the Imperial Government. In Australia as much as 93.74 per cent. of such functions come directly within the scope of the responsibility of the general government of the various States.

This is best appreciated by contrasting the proportion of Loans or Capital expenditure incurred under the general functions of government in respect of special public works and services in Australia and the United Kingdom, as in the accompanying corporation table:—

PUBLIC DEBT IN THE UNITED KINGDOM AND IN THE SIX STATES OF AUSTRALIA.

Illustration showing the Scope of the General and Local Government of the Six States of Australia, contrasted with similar function discharged and variously distributed in the United Kingdom under the control of General and Local Government, and among Private Railway Corporations.

CONTRACTED OR INVESTED IN.	PUBLIC DEBT INCLUDING INVESTMENTS IN RAILWAYS. General Government (000, £'s omitted).	Local Government (000, £'s omitted).	Private Railway Corporation (000, £'s omitted).	All. (000, £'s omitted).	All. Per Cent. to Total.	All. Per Head	Capital Investments per year during last five years. Amount (000, £'s omitted).	Per Head	Annual Rate p. Cent.
UNITED KINGDOM, 1905-6—						£ s. d.		£ s.	...
Railways and Tramways	...	...	1.344,821	1,344,821	50.57	30 16 0	...	...	...
Other Public Works & Services	...	540,401	...	540,401	20 33	12 7 7	...	...	...
Undefined (Imperial Debt)	774,164	...	...	774,164	29.11	17 14 8	...	...	...
Total United Kingdom......	774,164	540,401	1,344.821	2,659,386	100	60 18 3	64.990	29 9	3.75
Total per Cent. to Total ...	29.11	20 32	50.57	100	...	...	...	...	...
Total per Head	£17 14 8	£12 7 7	£30 16 0	£60 18 3	...	60 18 3	...	29 9	...
SIX STATES OF AUSTRALIA, 1906-7—									
Railways and Tramways.........	141,271	...	...	141,271	55 15	34 5 9	...	...	...
Telegraphs	3,752	...	...	3,752	1 47	18 5	...	...	...
Roads, Bridges, etc.	18,397	...	...	18,397	7.[illegible]8	4 9 4	...	...	...
Harbours, Rivers, Lighthouses	6,989	...	...	6,989	2 73	1 13 11	...	...	...
Water Supply and Sewerage ...	30,093	...	...	30,093	11.75	7 6 2	...	...	...
Defences	2,409	...	...	2,409	.94	11 8	...	...	...
Other Public Works & Services	28.202	16 000	...	44,202	17.26	10 14 7	...	...	...
Unexpended Balance..............	9,036	...	...	9 036	3.52	2 3 11	...	...	...
Total Six States Australia	240,149	16 000	...	256 149	100	62 3 7	5 17[illegible]	25 1	2 30
Total per Cent. to Total ...	93.74	2 26	...	100	...	...	...	...	...
Total per head	£58 6 0	£3 17 7	...	£62 3 7	...	£62 3 7	...	...	...

SUMMARY.

	Thousand £'s.	Per Head. £ s. d.
General and Local Public Debt, less Capital invested in Railways—		
UNITED KINGDOM..	1,314,565	30 2 3
SIX STATES OF AUSTRALIA	114,878	27 17 10

GROWTH OF POPULATION, AND CAPITAL INVESTMENTS IN RAILWAYS AND OTHER PUBLIC WORKS IN THE SIX AUSTRALIAN STATES AND IN CORRESPONDING CAPITAL INVESTMENT IN THE UNITED KINGDOM IN THE PERIOD 1801-1906-7.

SIX STATES OF AUSTRALIA							UNITED KINGDOM.							
Period.	Population at close of each Period.	Increase within each Period. No.	No. of yrs.	Per cent. to 4,119,481.	Average Annual Increase. No.	Annual Rate.	Period.	Population at close of each Period. No. Mils.	Increase within each Period. No. of yrs.	Per Cent. to 43.65 Mils.	Increase Mils.	Annual Rate. per cent.	Average Annual Increase. Amount Mils.	Ave age Annual Increase Per Head.
1801..............	6,058	...	...	0.15	...	...	(1821)........	20 89	...	...	...	...		
1801-1871........	1,668,367	1,662 369	70	40.35	23,748	8.36	1821 1871...	31.78	50	...	11.59	0 82	0.23	
1871-1891........	3,183,237	1 514,850	20	36 77	75,743	3 28	1871-1891...	37.73	20	...	6.25	0 91	0 31	
1891-1901-2.....	3,883,079	698.842	10	16.99	69,984	2.01	1891-1901-2	41.45	10	...	3.72	0 95	0.37	
1901-2-1906-7...	4,119,481	236,411	5	5.74	47,282	1 19	1901-1906...	43.65	5	...	2.20	1 04	0.44	
1905-6-1906-7...	4,119,481	67,051	1	1.63	67,051	1.65	1905-1906...	43.65	1	...	0.43	0.95	0.43	
1801-1906-7.....	4,119,481	4,113 423	105	99 85	38,850	6 35	1825-1906..	43.65	85	...	22.76	0 87	0 27	
				100										

CAPITAL INVESTMENTS.

Period.	£	£	No.	Per cent	£	Per cent.	Period.	Mil. £'s	No	Per cent.	Mil. £'s	Per cent.	Mil. £'s	Per Head. Six States	Per Head. U.K. *
								*						s. d.	s. d.
1842...........	45 900	...	...	...	...	...	1861............	110.0	...	5 83	...	...	...	...	...
1842-1871.....	30.139.880	30.093,980	29	...	1.067,000	25 08	1861-1871......	552 6	10	23.48	442.6	17.49	44.26	...	...
1871-1891.....	155.117,773	124.977.893	20	..	6,248,844	8.54	1871-1891......	933.0	20	20.18	380.4	...	19.02	...	...
1891-1901-2..	214,253,000	59,135,227	10	24.67	5,913,523	3.28	1891-1901-2 ...	1220 4	10	15.56	293.4	...	29.34	36 3	10 0 †
1901-2-1906-7	240,149,727	25.896,727	5	10 78	5.779 345	2.31	1901-2-1906-7	1885.2	5	25 26	664.8	...	132 96	33 6	14 10†
1905-6-1905-7	240,149,727	1,722,727	1	0.72	1,722,727	0 72	1905-6-1906-7	86 20	1	4 57	86 20	...	86.20	28 10	62 6 ‡
1842-1906-7..	240.149.727	240,103,827	64	99 98	3 752.000	13.32	1861-1906-7 ...	1885.2	45		1775.2	6 52	...	8 4	39 6 ‡
1871-1906-7..	240,149,727	210 009 847	35	72 40	6,000,252	6.11	1871-1906-7 ...	1885.2	35	64.84	1332.6	0 57	38 08		

* Exclusive of Imperial Debt Investments.

† Does not include Local Government Capital Investment.

‡ Includes Local Government Capital Investment.

R. M. JOHNSTON.
Government Statistician,
Tasmania

Hobart,
May 25th, 1908.

It does not require much knowledge of industrial economy to realise the fact that the wealth of any country is greatly multiplied by the introduction of machinery, which facilitates the fresh creation of products or diminishes the cost of production or transport. All the hopes of economists for the amelioration and improvement of the material condition of a people depend upon such agencies increasing at the initial stage at a greater ratio than population, and even at a later stage, as in the United Kingdom, the investments in extending its railways and other public works of local bodies during the last four years increased from £1,623 to 1,885.2 million pounds, or at the rate of £65.5 million pounds per year, equivalent to 30s. 8d. per head per year. Australia, which is still in the initial stage of development, has, in similar investments, only increased during the same period from 222.87 million pounds to 240.14 million pounds, or at the rate of 4.31 million pounds per year, equivalent to 24s. 8d. per head per year. Taking all these matters into consideration, it is clearly demonstrated that Australia's Capital investments in Railway construction and other Permanent Public Works are, in relation to her initial stage of development of an area nearly as large as Europe, and also in relation to her population, progressing at a much slower rate than the United Kingdom, which long ago had advanced to a high stage in all equipment of this nature.

THE IMMEASURABLE INDIRECT BENEFITS OF RAILWAYS.

It is also a very common fallacy to assume, as some do, that the only object which the several State Governments of Australia had in view in opening up the country by means of railways was confined to the direct profit which they might possibly receive into the State revenues from the net receipts of the railways, themselves regarded as private undertakings; that is the only view they can take of the vast wealth-producing influence of railways to a country is restricted to the petty consideration as to how far the extension if Railways benefit the Railway carrier, as such. If the mere receipts from freight cover working expenses and the

interest on borrowed or invested Capital, the Railways, according to this restrictive view, are productive; if the working receipts fail immediately to wholly cover both charges, they are deemed to be unproductive, a loss to the country, and a menace to its financial stability. This reasoning is obviously faulty.

To the Country as a State, or to its Producing Industries or Consumers, the whole of the freight charges of a Railway, regarded as an item of State revenue—even though covering working expenses and interest on Capital—form the merest fleabite as compared with the actual immeasurable indirect value, added to the country's wealth-producing industries.

The principal additions to the wealth of the country due to Railways are derived as follows:—

(1). By the saving of time and of cost of transit.

(2). By giving commercial value to vast natural products hitherto lacking value, owing to lack of cheap modes of transit.

(3). By the impetus given to the creation of fresh wealth in areas formerly barren or unproductive.

To estimate the "Wealth of Exchange" added to any country—especially a State with vast areas of virgin soils—would be a difficult matter. We may know this wealth to be great in itself, and vastly of greater importance than the possible revenues of the Railway in itself as an undertaking, but we have no direct means of ascertaining its value quantitatively. Items (2) and (3) can only be vaguely guessed at. But the wealth and other advantages gained by saving time and labour (1) through the improvement in means of transport can be very closely approximated.

The gain from this hidden cause, although of necessity not seen in the receipts of the Railway regarded as an undertaking, becomes at once apparent when we try to realise the difference in cost of transport as between the Railways now in operation and the more imperfect means in common use on bad roads prior to their introduction.

Prior to the opening up of the States' lands and the Loans expenditure on Roads, Bridges, and Harbours, the expenditure of time and labour in effecting the necessary transport between points of production and centres of population and ports of trade was very great. Even in the limited areas when macadamised roads existed, the cost of transit formed a heavy tax upon either reproducer or consumer, or both, accordingly as the product was intended for foreign or local consumption.

This aspect of the case was carefully investigated in Tasmania by the writer soon after its first Railway (the Launceston and Deloraine Railway) was opened for traffic in February, 1871. It was found that prior to regular daily timed service, and the consequent reduced carriers' freights forced upon the latter by the Railway competition, the average for carriers and coaches throughout the State averaged as follows:—

	Carriers & Coaches prior to 1870.	Current Charges (Govt. Rys.)	Decrease.	
	d.	d.	d.	per cent.
Average Fare per Passenger per Mile	2·92	1·06	1·86	63·70
Average Freight per Ton per Mile of goods of all Descriptions	10·00	1·82	8·18	81·80

The true interpretation of this remarkable reduction in cost of transit within a very brief period is simply this: that for every £1 now obtained as gross receipts, there is a hidden value saved to either producers or consumers of the country of at least £2, apart from the actual profits of the Railway as an undertaking.

Let us now make an estimate of what this hidden value of railway speedy and cheaper transits means to the States of Australia from the working of State railways in the year 1906-7.

In this year there were open for traffic 14,232½ miles of railway, whose Capital Construction and Equipment amounted to £140,707,474.

			Per cent to cost of Construction.
(1)	The Gross Receipts were	£14,455,451	10 27
(2)	The Working Expenses were	8,519,110	6 05
(3)	The Net Profit on Working was	5,936,341	4·22
	Less Interest on Loans Capital	5,055,063	3·59
Net gain to State Revenue for the year		£881,279*	0·63*

If we now take into consideration the saving in time and cost of transit as a hidden value to the States, which was shown to be not less than £2 for every £1 gross receipts, we arrive at the conclusion that, apart from all other indirect advantages specified elsewhere, its value represents in the year 1906-7 a sum of £28,910,902, equivalent to a present capital value of as much as £826,000,000.

The whole of the States' indebtedness of £240,149,000 seems a small affair alongside of this bona fide, though hidden, State benefit.

A study of these significant figures should give pause to all superficial or interested critics who may venture to discuss the wisdom or otherwise of the policy of the Australian States, which, notwithstanding errors in the practical work of carrying out the functional policy of the State, has resulted in giving room and a productive field of work to a population of 2.55 fold the number of 1870; and, after deducting the share of our co-partners—our creditors if you like (that is, the nominal debt of £240,148,727), we have a balance of the people's income in our favour, whose present capital value exceeds that of 1870 (when there was only a debt of £28,328,000) by a sum of £3,473,000,000, besides a valuable asset in our 14,067 miles of railway, whose effect in saving of cost of transit alone is estimated in the year 1906-7 to be equivalent to a present capital value of £826,000,000 sterling.

And further, let it be noted that, notwithstanding the Interest Burden on Australian State Debts has increased since 1870 by 24s. 8d. per head, such has been the increase in the direct working profits of the State

*Note.—This item alone represents a present capital value of £25,179,371, or as much as 17.89 per cent. of the total value of Capital invested in construction.

railways alone—viz., 24s. 6d. per head in the year 1906-7, that the total interest burden on all State Debts, amounting to £240,149,727, has only been raised by the insignificant sum of twopence per head of the population.

This means (apart from the immeasurable material benefit of opening up the hitherto waste lands by the cheap and rapid mode of transit) the surplus profit to the State Treasuries from railway profits alone now practically has wiped off the taxpayers' interest burden on the whole of the existing unredeemed Public Debt of £240,000,000.

The question now to ask of all panic-struck pessimists, or "foes of our own household," is, Would the present population, with its relatively high standard of living and its vastly increased wealth, have existed had the "retrenchment and ruin" scare of the year 1870 succeeded in forcing upon the Colonies at that time the retrograde cry of 'No borrowing" and "Retrenchment"?

Those who answer this question in the affirmative are, indeed, dangerous advisers on financial and economic matters affecting the State.

PART II.—THE WRONGFULNESS OF CHARGING PRINCIPAL OF COSTLY ORIGINAL WORKS OF CONSTRUCTION TO THE CONSOLIDATED REVENUE, AND THROUGH IT UPON THE TAXPAYERS EXISTING IN THE YEAR WHEN SUCH HEAVY EXPENDITURE WAS CONTRACTED.

The injustice to the taxpayer of the day, and the utter impossibility of the Government of the day to continuously adjust its schemes of taxation to suit the revenue needs of each year, as a consequence of any attempt to charge the Principal Original Costly Works of Construction, Expenditure such as Railways, Jetties, and Harbours, is best illustrated by comparing the effect upon the taxpayers of each year in Tasmania, were the burden of original cost wholly concentrated upon the Consolidated Revenue of the year, instead of, as was done, THE INTEREST BURDEN OF THE AGGREGATE CAPITAL INVESTED. This method alone enables a Government to spread the burden of the capital over present and future taxpayers equitably, in proportion to the benefits they respectively derive yearly, arising from the valuable assets created by the original capital investments which are continuously preserved in their pristine condition by the yearly maintenance renewals and repairs, which, with other ordinary working expenses are, and should alone be, a legitimate charge upon the Consolidated Revenue of the year.

THE PUBLIC DEBT OF TASMANIA.

The public debt of Tasmania on 30th June, 1906-7, amounted to £9,528,933. £7,528,000, or nearly four-fifths, was created since 1881, in a period of 25 years. Within this period the larger original outlays upon Railways, Roads, Bridges, Jetties, and Harbour were mainly incurred during five particular years—viz., 1884, 1886 and 1889, 1890 and 1891.

The following comparative table illustrates how disastrous and how unjust it would be to the taxpayers of those five years, if it were at all possible to defray the contracted capital expenditure of such necessary public works by a charge of the Principal, instead of interest thereon, upon each year's Consolidated Revenue Fund:—

GROWTH OF PUBLIC DEBT OF TASMANIA AND EFFECT UPON TAXATION AND INTEREST BURDEN.

Year.	Absolute Debt. Amount. (000 £'s Omitted).	Relative (per Head). (Mode A.) Charging Revenue with Interest only Actual.	(Mode B.) Charging Revenue of Year with the Principal.	C. Increase or Decrease in Taxation of each Year if Method (B) had been adopted. Increase.	Decrease.	D. Actual Total Taxation in Each Year.	E. Probable Total Taxation if Mode (B) could have been adopted.
	£	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1881	2003	...	...	...	...	59 2	...
1882	2050	23 1	...	...	...	62 1	...
1883	2385	23 9	38 2	14 5	...	63 7	78 0
1884	3202	26 10	128 7	121 9	...	54 11	176 8
1885	3357	28 2	23 11	...	4 3	57 1	52 10
1886	4026	28 11	101 9	72 10	...	57 6	130 4
1887	4109	31 11	10 1	...	11 10	56 2	44 4
1888	4390	31 4	40 9	9 5	...	59 2	66 7
1889	5019	34 1	88 4	54 3	...	60 3	114 6
1890	6432	34 6	194 8	160 2	...	63 3	223 3
1891	7110	35 5	88 9	53 4	...	67 5	120 9
1892	7399	40 4	38 2	...	2 2	57 4	55 2
1893	7645	43 3	32 7	...	10 8	52 0	41 7
1894	7779	43 8	17 5	..	26 3	55 9	28 9
1895	8180	42 6	51 8	9 2	...	60 2	69 4
1896	8251	41 6	8 10	...	32 8	59 3	26 7
1897	8390	39 10	16 10	...	23 0	61 3	38 3
1898	8412	38 5	1 8	...	36 9	64 11	28 2
1899	8395	37 2	1 11	...	39 1	64 2	25 1
1900	8511	37 2	13 4	...	23 10	74 7	50 9
1901-2	8854	37 3	39 5	2 2	...	61 9	63 11
1902-3	9228	37 9	42 3	4 6	...	50 6	55 9
1903-4	9318	38 4	10 0	...	28 4	58 3	29 11
1904-5	9471	38 4	10 4	...	28 0	61 2	33 2
1905-6	9693	39 4	25 1	...	14 3	64 2	49 11
1906-7	9884	40 5	20 7	...	19 10	69 6	49 8

The illustration given in the foregoing tabular comparison is most eloquent in demonstrating three most important ethical and economical truths, viz.:—

(1). The injustice and impossibility, if attempted, of collecting from the people of the year a tax of, say, 114s. 6d. to 223s. 3d., as would be the case in the years 1884, 1886, and 1890, if the method were adopted of charging the principal of new costly works to the revenue of the year in which the enterprise was contracted. The tax in 1890 by this method would exceed the highest yearly tax ever collected in Tasmania by 148s. 8d. per head.

(2). The impossibility on the part of the Government to construct new large costly works necessary to the proper development of a new country by such equitable yearly instalments as would do justice to the taxpayers of each year, if charged with principal instead of the interest thereon.

(3). The utter impracticability, if not impossibility, of any Government to devise fresh yearly schemes of taxation, if the principal instead of interest thereon were charged to the year in which expenditure was to be contracted, owing to the frequency of its extreme and eccentric fluctuations.

We can more easily realise the force of these conclusions if we ask ourselves the questions—What would happen if the directors of a large corporate body, such as the London and North-Western Railway Company of England, in the projection of a new branch of extension, proposed to the shareholders of the moment (whose individuality is ever changing hour by hour, like the taxpayers of a State) to charge the principal of cost of construction and equipment to the existing shareholder (individuals!), either by an abstraction from their rightful profits from the earnings of the original system's working, or by mulcting them in a heavy outlay which, on purchasing stock of the company, was never contemplated nor allowed for by them in the selling price? Why, the shareholder would regard it as a barefaced robbery, and would at once depose the Board

of Directors who were mad enough to move such a proposal. When, in the United Kingdom, persons are found guilty of deceiving the shareholders and the investing public by secretly appropriating Capital, Loans, Money for new works of original construction, to credit of ordinary working revenue, and so doing a gross wrong to the unsuspecting investors; or, on the other hand, secretly charging working expenditure with the principal of new costly works of construction, and so robbing the shareholder of the year, the acts of such persons would be deemed by English law to be of the nature of high misdemeanour, and there are instances where guilty directors and guilty chief accountants of Railways have received sentences of 16 years' imprisonment for such an offence against law and justice.

PART III.—SINKING FUNDS FOR THE ABSOLUTE REDEMPTION OF EXISTING AND FUTURE STATE DEBTS.

Having already demonstrated that the Wealth of the People of the Australian States since the introduction of Loans has increased in a vastly greater ratio than either Population or the present aggregate capital value of the unredeemed State Debts; and also, that, owing to the consequent increase of population and the growing working profit of State Railways to State Treasury revenues, the burden of interest for State Debts of £240,149,727 in the year 1906-7 only exceeds by 2d. per head the corresponding interest burden for State Debts in 1870, when the latter only amounted to £28,328,000, it becomes an important matter to examine the question, now so frequently proposed, as to the absolute redemption of present and future debts by means of yearly appropriation from current States revenue accounts towards an absolute Redemption Sinking Fund within a given term of years from the present date as regards debts incurred in past years, and similar provision for freshly incurred debts from the date of their contraction.

There are many suggestions recently advocated by very able public men interested in the problems of State Finance for such a purpose.

But the real question is: How far should the taxpayer of the day burden himself, not only with his own share of burdens of the State for which he in his own time is responsible, but also with burdens incurred by a former generation of taxpayers, with the view obviously of giving a much lighter burden to future generations of taxpayers, who (having the same or a fuller benefit of the same Asset) by the natural increase of numbers, would be financially more able to bear such absolute weight of burden of interest on necessary State Debts than the taxpayers of to-day.

The suggestions made by many of such advisers, in promoting the idea of creating such Sinking Funds for the Total Redemption of existing and future State

Debts, within the limits of periods of, say, 40 to 60 years, though eminently prudent and economic from the standpoint of a private individual, may still be open to question or qualification when applied to the economics of a corporate body, such as a Railway, Joint Stock Company or modern Industrial State.

The policy for determining the extent, form, and duration of Public Loans, contracted for the purpose of investment in any advantageous scheme of remunerative or reproductive work or purpose, should differ widely in some important respects, accordingly as it affects the future outlook of the private individual, the corporate body, or the Industrial State, for the following reasons:—

The "Life-expectation" of an individual person is limited, and rapidly diminishes at every stage—say after the age of 20 years. In like manner his natural powers, physical and mental, gradually decline, especially so towards the close of the average individual life.

The average Breadwinner of the State may be taken as the Shareholder unit of the State, corresponding somewhat to the individual as the Breadwinner of the Family Circle. The average State Breadwinner's life, however, is practically interminable—never grows older with years—and, in the aggregate, whose individuality is ever changing in young prosperous States, the Breadwinners or Taxpayers at the end of a century are likely to possess fully five times the power and revenue-yielding ability possessed by the aggregate Breadwinners or Taxpayers of the same State at the beginning of the century, so far as any fixed amount of debt is concerned. Even if the present debt increased in the ratio of population, the latter, from the greater wealth producing asset, kept up to present value by current revenue for renewals and repairs, without any redemption of debts, would still be less burdened per head than the State Taxpayers of to-day.

The important distinction between the Individual Family Breadwinner and the corresponding unit—the Taxpayer of the State—is perhaps best illustrated by comparing the present capital value of £1 respectively of the annual incomes of the private individual and the State Taxpayer, as in the following abstract:—

(1). An individual—say 20 years of age—possessing a fixed income, assumed to be terminable at death.

(2). The average existing unit Taxpayer of the State, who may be regarded not only as possessing a practically interminable income, but, owing to the natural increase of the population, his present capital value, instead of diminishing, gradually increases from year to year. In this way a given fixed burden, which may at the beginning of a century in a State, with a population of, say, 4,000,000, demand a tax of 41s. 11d. per head, would only demand for the same burden a tax of 7s. 8d. per head, when the population then increased, probably, to over 22,000,000—that is at the close of the century.

TABLE SHOWING THE COMPARATIVE PRESENT CAPITAL VALUE OF EVERY £1 OF THE ANNUAL INCOME AT DIFFERENT PERIODS OF A SINGLE LIFE AND OF THE AVERAGE ANNUAL INCOME OF A STATE BREADWINNER RESPECTIVELY.

Column (A) indicates the year.

Column (B) indicates at each period the "Expectation of Life in Years of the Single Individual Life."

Column (C) indicates the relative increase of State Breadwinners at each period owing to the natural growth of population.

Column (D) indicates the Present Capital Value of every £1 of the fixed annual Income of a Single Individual terminable at death. The Individual is assumed to be of the age of 20 years at the year 1906. The present Capital Value gradually shrinks with the increasing age of the Individual.

Column (E) indicates the Present Capital Value of every £1 of the annual Income of the average Taxpayer of a progressive State. The life of the State Taxpayer may be regarded as practically interminable, and the Present Capital Value at each successive period increases in accordance with the natural increase of the population.

(A)	(B)	(C)	(D)	(E)
	No.	No.	£	£
1906	42 10	1	21.83	27.66
1916	34.73	1.17	20.00	30.95
1926	27 39	1.39	17.28	36.74
1936	20.27	1.64	14.21	43.60
1946	13.81	1.95	10.92	51.76
1956	8 49	2.32	7.24	61.45
1966	4.66	2.75	4.23	72.95
1976	2.31	3 17	2.20	84.03
1986	0.75	3.88	0.75	102.80
1996	nil	4 60	nil	122.10
2006	nil	5 47	nil	145 40

From such considerations the writer is of opinion that the State Taxpayers of the day stand, in relation to ever-changing individuality of the State Taxpayers of the past and the future, in exactly the same ethical and economical relation as do the existing Shareholders of a Private Railway Corporation to past and future Shareholders of the same concern; and, consequently (apart from the lack of any necessity to do so), there are neither moral nor economical grounds why either State Taxpayer or Shareholder of the day should, in addition to their own equitable share of burden mulct themselves in additional expense as by Sinking Funds for the purpose of relieving their future representatives of a portion of their own fair and equitable share of burdens. The latter, too, from increasing value of Loans, Assets, increasing number and financial ability, should be in a stronger position than their representatives of to-day to fully discharge all reasonable obligation falling naturally upon them.

In conclusion, I am strongly of opinion that Sinking Funds for the absolute redemption of Loans invested in Railways, Harbours, and other Public Works should be restricted to the portions of such Loans whose Assets are short-lived and, like the terminable life of Marine Vessels, cannot be permanently preserved in original pristine value and utility by the proper yearly contributions to Maintenance, Renewals, and Repairs from current revenue, by which means the whole Permanent Way, Machinery, and Equipment of Railways are ever kept up to their pristine value as State Assets.

NOTES ON THE RIVER GORDON AND ON THE NEED FOR RESERVATION OF LAND ALONG ITS BANKS.

By J. W. Beattie.

(Read July 13, 1908.)

The River Gordon is about four miles distant from Sarah Island. Its entrance is narrow, with a bar, upon which there is a depth of water of about two fathoms, deepening almost immediately to 10 fathoms. The entrance to the river has now been well beaconed, and renders navigation safe. Approaching the Gordon, the surrounding mountain scenery is very grand. Away to the south the D'Aguilar Range and Mount Direction stand rugged and picturesque, the next in importance being the Elliott Range, its southern trend gently sloping until lost in the billowing ranges which separate it from the D'Aguilars, while its eastern extremity ends in high, broken abruptness.

Following the Elliott Range eastward, we next notice an elevated flat belt of open country, called the High Plain. Across this plain came Sir John and Lady Franklin and party, on their memorable overland journey from Hobart in 1842, piloted by the late Mr. James Erskine Calder, afterwards Surveyor-General of Tasmania. They reached the Gordon about 10 miles from its entrance, at a reach of the river called "Preservation Inlet," where the relief vessel the "Breeze" lay awaiting them. Following the High Plain are four fine-sized mountain peaks, called by Lady Franklin "The Craycrofts," after relatives. One or other of the Craycroft peaks shows nicely in some of the Gordon scenery. Directly eastward from the Craycroft Range the tops of the Engineer Range are just visible.

Entering the river, its extensive shallows on either side are broken by rushes and driftwood, forming pleasing foregrounds to the glorious panorama which stretches from north-east to west. This is a scene to be remembered, if caught under favourable conditions—a clear early morning and a dead calm. The great West Coast Range, terminating here, shows Mounts Jukes, Darwin, Sorell, and Strahan, grouped up in great grandeur, while farther westward the harbour is closed in by Grummet and Sarah Islands, and the distant background of the wall-like ranges terminating at Table Head.

The general scenery of the Gordon represents high gorges, densely wooded to the water's edge, with long reaches and beautiful bends. There are stretches of open country in parts, but for 24 miles, until the River Franklin is reached, it retains the character I have indicated.

There is a fine outcrop of limestone at Limekiln Reach, 12 miles from the river entrance, which in the early days was quarried and burned by a party from the Sarah Island establishment.

About two miles further along brings us to Butler's Island, a peculiar rock close to the eastern side of the river. It received its name from the officers of the Sarah Island establishment, Captain Butler, of the 40th Regiment, being one of its best and most energetic commandants. The high rock to the west of the island I named Cuthbertson's Head, after Captain Cuthbertson, who was the first commandant of Sarah Island, and who was drowned at the entrance to the River Gordon.

Pining, as carried on in the Gordon and vicinity today, is mostly confined to the creeks and small rivers which flow into the main stream. All the pine timber which grew so abundantly at one time along its banks, and in the adjacent flats, has been worked out years ago, and it will take a century at least for the young forest trees to mature and be fit for use.

Among the surroundings of the higher waters of the River Franklin, in the vicinity of the Frenchman Range, where the country is excessively steep and rugged—roads are quite out of the question, and the work of pining is both difficult and dangerous, most of the pine

being found on the top and sides of the precipitous hills. When felling is completed the tree is trimmed and barked, head cut off, and end pointed, ready for "shooting." Jacks of the Trewhella pattern are used to start the tree down hill, when it "shoots" into the river bed below, and there awaits the winter floods to carry it onward to the Gordon. The Franklin is navigable for twenty miles from the Gordon for small boats, and in that distance there are 150 rapids, some very high and dangerous, and in surmounting them the boat has often to be carried on shore round them before progress further can be made. In view of the annually increasing scarcity of suitable timber for the world's requirements, it would appear to be a matter deserving of great attention at the hands of the Government to endeavour by every means within its power, not only to conserve the existing forests, but to take every step possible to increase the supply of so valuable a timber, with possibilities in the future of considerable magnitude.

Gould's Landing, a well-known Gordon landmark, is 20 miles from the river entrance, and about one mile above Butler's Island. The river is fairly open from the island to the landing, which is situated on a river flat, but to this point from its junction with the Franklin the Gordon flows through fine gorges, and is very impressive. Gould's Landing may be said to mark the limits of safe navigation for large craft, although the river can be navigated as far as the first rapids, one and a-half miles above the landing. Here is the first obstruction to the safe navigation of the Gordon. Two groups of heavy rocks lie across the river, separated some little distance from each other. They are known as the first and second rapids. These once negotiated, the river continues unobstructed to the junction of the Franklin, about two miles distant. The River Franklin junctions with the Gordon at 24 miles from Macquarie Harbour. At its entrance is Pyramid Island. The Franklin takes its rise from Lake Dixon, near Lake St. Clair, and from its source to its junction with the Gordon waters is very confined, rough, and dangerous. Floods in this river are exceptionally severe, the water rising during the heaviest floods as high as 60 feet above normal level, ordinary floods reaching 30 feet. The flood waters develop a tre-

mendous velocity, racing to the Gordon at 20 miles an hour.

Returning now to the Gordon. Above the Franklin the Gordon is obstructed by numerous rapids. For 10 miles its course is through low country, about fifty rapids being met with in that distance. Following up the river, deep gorges are met with up to the Wilmot Range, 25 miles from Gould's Landing, and expert boatmen are able to reach this point.

The source of the Gordon is in Lake Richmond, under the shadow of the King William Range, whence it flows through picturesque surroundings in the Rasselas Valley, making a long and graceful sweep round Mount Wright, which is known as "The Great Bend." From here its course is past the Thumbs Range in deep and rugged gorges to the eastern side of the Wilmot Range, 20 miles distant, the last few miles being through low button-grass country. From Lake Richmond to the Great Bend is about thirty miles, and the total length of the river from its source to Macquarie Harbour about 95 or 100 miles.

Floods on the Gordon occur in April generally, and are usually heavy. There is a break of frosty weather, in June particularly, then, from July to November, floods are always prevalent. In heavy floods the river rises to 30 and 40 feet, and in ordinary floods to 20 feet. These heights apply above Gould's Landing, where the river is narrowest. From the Landing to the mouth of the river, the flood waters reach the height of from 16 to 8 feet. Below Gould's Landing the current attains a speed of approximately 8 to 10 miles an hour, although in the narrower parts the velocity is very much greater. At the second rapids, for instance, where the river is narrow, and has an acute bend, as the waters career down they dash into the bank at this bend, producing a scene of the wildest confusion.

Apart from the aesthetic side of the Gordon's attractions, its scientific aspect, as contributing a unique display of our West Coast flora, must become apparent to all, and should alone warrant beyond question its rigid protection against axe and fire. It is necessary that urgent measures be taken in bringing about this protection, for already whispers of the erection of a sawmill are in the air, and this, if once established without

restrictive precautions, would undoubtedly mean the "beginning of the end" to the beauty of the Gordon. Surely we must see to it that such a menace should not for one moment be allowed.

Some attempt at protection has, I believe, already been made, the Government having reserved a strip of land five chains wide on each side of the river, for a distance of 16 miles from the entrance at Macquarie Harbour. This is totally inadequate to fully protect the river from the depredations of the timber hunter. The area must be greatly extended, and my proposition is that all the hillsides immediately fronting the river should be reserved, allowing five or ten chains on the flat parts of the river, reservation to commence from the Macquarie Harbour entrance, and end at one mile beyond the Franklin River Junction, which would give a total length of 25 miles, and would effectually protect the whole of the beautiful scenery of the river. This reservation cannot interfere with the pine industry, no pine being available now on the banks of the river, nor would timber-getters suffer inconvenience, as their sphere of labour would lie outside the reserve.

The economic value of this reserve to the state, apart from aesthetic or scientific considerations, may be regarded as practically "nil," the land being worthless for settlement or agriculture, and no minerals have, I believe, been discovered within the proposed area of protection, so that, under such circumstances, the Government lose nothing by its reservation, but, on the contrary, would gain, now and in future years, the approbation and esteem of all right-thinking people of this state.

The preservation of scenery in other parts of the world is receiving the greatest attention, and even in England a society has been formed for the preservation of Swiss scenery. How much greater is the necessity existent in a country like Tasmania, relying so much upon her tourist traffic, to preserve by every means within her power attractions without which such a traffic would diminish rather than increase, to the serious loss of the state. One hesitates to put this selfish aspect of the case before a learned society, but "necessity knows no law," and, after all, a public awakening may be better aroused by a proposition in this form rather than from a more scientific standpoint.

A NATIVE BURIAL GROUND ON CHARLTON ESTATE, NEAR ROSS. (PLATE V.).

By Fritz Noetling, M.A., Ph.D., etc.

(Read August 10th, 1908.)

The customs observed by the Aborigines in disposing of their dead relatives and friends have been most carefully described in Ling Roth's book on the Aborigines of Tasmania (1). But in perusing this compilation anyone must be struck by the rather conflicting accounts given by different observers.

The earliest, and probably the most trustworthy description of a native grave is given by Peron (2). The corpse was burnt, the ashes covered with a layer of grass arranged in connective rings, forming a low cone, and this was held in position by small wooden wands crossing one another at the top of the cone, their ends being pushed in the ground and held in position by a large flat pebble. Above this was erected a curious tetragonal pyramid of wooden poles, covered with bark and tied together at the top. This structure covered a quantity of ashes, and Peron is most explicit to explain how he extracted the bones from this grave.

Peron's description is accompanied by a sketch, copied in Ling Roth's book in which three graves are seen—a complete one, another opened in front, and a third one showing only the central cone without the outer pyramid of bark.

As Peron states that "the monument," as he calls it, was the only one found by him, it is obvious that the sketch is not an exact representation of what he has observed, but rather a reconstruction based on actually observed facts.

Peron's description is rather emotional, attributing to the Aborigines feelings that he, the sentimental Frenchman of the 18th century, may have had, but

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(1) Ling Roth, The Aborigines of Tasmania, 2nd ed., Halifax (England), 1899, pp. 116-122.

(2) Peron and Freycinet, Voyage de Decouvertes aux Terres Australis, Paris, 1807-1816.

which it is safe to say were hardly those of the Aborigines of Tasmania. This touch of sentiment rather mars his otherwise clear description, and he has on account of this probably overlooked certain facts which would be of the greatest importance to us were they recorded.

The account given by A. Cottrell (1) refers rather to the customs observed than to the grave itself. According to him the corpse was burnt, and the relatives, having collected the ashes, besmeared their faces with it, and tied the remainder up in a piece of kangaroo skin, which they wore about their person. According to West, the skull of an infant was taken up from the ashes, wrapped up in a piece of kangaroo skin, and worn by a female, probably the mother. There cannot be the slightest doubt that fragments of human bones, tied up in a bit of skin, were highly prized as amulets or charms by the Aborigines. However interesting that may be, it does not bear on the question at issue, viz., the disposal of the dead bodies.

It is certain that the Aborigines burnt their dead, but there is a considerable difference as to the disposal of the ashes. If the practice referred to by Backhouse, Cottrell, and West had been extensive, there would have been hardly any ashes left. On the other hand, Peron's statement is so explicit that it is safe to assume that always a considerable quantity was left, which was eventually covered in the way described by Peron. It is therefore very probable that it was customary to burn the dead, and some of the remains were worn as charms or amulets by the relatives, who probably besmeared their faces also with the ashes (3).

(3) I quote from Ling Roth. It seems that a good deal of G. W. Walker's statements are based on information given to him by A. Cottrell.

(4) This fact throws a curious sidelight on a custom referred to by the Bible—extreme grief was expressed by going in sackcloth and ashes. It is natural to ask, why ashes? If we assume that this custom, used by later generations without knowing its real meaning, was based on the custom of early mankind to besmear their faces with the ashes of a deceased relative, we have probably the true explanation of anotherwise strange custom. To besmear the face with the ashes of the deceased expressed the greatest grief for its loss, and after mankind became more civilised they no longer used the deceased's ashes, but simply put any kind of ashes on the head.

Some writers also refer to the custom of placing a dead body in an upright position in a hollow tree. As far as I can see this was only done in cases of emergency, when there was no time to burn the body at once; but they were certainly subsequently burnt.

And now a very curious question arises: Did the Aborigines dispose of their deceased on the spot where death took place, or did they carry them to certain places habitually used for the purpose of cremation? It is pretty safe to assume that death mostly took place on the camping ground; some may have died while travelling, while others may have been killed at odd places in their internecine wars.

It is very strange to find that not a single one of all observers noticed whether the Aborigines had regular burial grounds or not. The only reference I can find is Braim (4), who states: "Whenever they approached places where any of their countrymen had been deposited, they would on all future occasions avoid coming near such spots, and would rather go miles round than pass close to them." The same authority states that "other tribes, again, when it was not convenient to carry off the dead body to some place of interment would put it into some hollow tree."

These two statements would imply (a) that there was a regular burial ground, (b) that the dead body was carried to it. Now, we know that the names of the deceased were never mentioned again by their relatives—in fact, thy seem to have had a superstitious fear of the spirits of their departed; and from this fact alone we may conclude that the dead were not indiscriminately buried. It is hardly probable that if anyone died at a regular camping ground they disposed of the dead body then and there in the way described by Peron and others. It is more probable that there existed certain areas, well known and to be avoided, where the remains of the dead were deposited. The question, however, is, Do such burial grounds exist? As already stated, no author but Braim mentions a burial ground; but if they

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(1) Braim, Thos. H., History of New South Wales from its settlement to the year 1844, II., p. 267, London, 1846. (I quote from Ling Roth, p. 62.)

exist, the traces left behind must be very fragmentary. It is evident that the wooden superstructure described by Peron cannot have stood for any length of time. It is equally certain that the grass covering soon rotted away; in fact, the second grave mentioned by Peron seems to have been in this dilapidated condition, and the first one, so minutely described, must have been of very recent origin. We can safely assume that after a few years nothing remained of the rather elaborate structure but a low earthy mound, in which a few stones were embedded, and even these relics were very perishable. We can only regret that Peron, led away by his emotions, did not make a closer examination of the two localities where he discovered the graves; if he had, the question whether the Aborigines used regular burial grounds or not would have been settled. Had he seen such little mounds of earth covered with a few stones, there could have been no further doubt that this place had been used as a regular burial ground.

A discovery which I lately made on Charlton estate, near Ross, seems to settle this question in favour of the existence of a regular burial ground. Mr. E. Cameron, of Mona Vale, informed me that a so-called native burial ground existed quite close to Charlton house. Following the fence behind the house in an eastern direction for about half-a-mile, we came on a most remarkable spot. The hill is apparently covered with sand, and right on the top the sand has been blown out for a length of about three hundred feet to a depth of over four feet. The remains of the covering layer of sand can still be seen towards north, and they are well marked in the photograph. The hill commands a fine view all round, and the photograph gives only a poor impression of the large area that can be overlooked.

On the loamy soil, about seventy to eighty little mounds of earth, irregularly covered with more or less rounded stones, can be seen. These mounds are about three feet in diameter, and very low; in fact, most of them are hardly raised above the ground. I opened several of them, but, except an irregular layer of whitish tenacious clay, covered by the ordinary reddish loam, I found nothing. There were not the slightest traces of bones. Fragments of stone implements were not un-

common, lying scattered about among the bigger stones.

Though no bones were found, I have not the slightest doubt that this place has been used as a regular burial ground by the Aborigines. There is no agency to which we could attribute the heaping up of a number of little mounds of earth in which large stones are embedded but to human beings. It is not very probable that these mounds represented fireplaces; if so, why should the whitish clay be invariably covered under a layer of red loam, in which rather heavy stones are embedded? The only way to account for these little mounds is to assume that they are graves of Aborigines, and, if this be so, they must be of great age. There is no doubt that these graves were some time ago covered by a deposit of blown sand, measuring not less than four feet in thickness, and in that way perfectly concealed. They became only exposed when the sand, instead of being deposited, was again blown away. Both the covering and the blowing out must have taken some time, and we know nothing about the length of the interval between, which may have amounted to a considerable number of years. It is therefore hardly surprising that no bones were found. The larger fragments had been taken away by the relatives; the smaller fragments, already much calcined by the fire, soon disintegrated into dust, and in coure of time the ashes turned into a whitish clay.

The numbers of mounds exposed proves that this place was regularly used for the disposal of dead bodies, and this proves Braim's statement as to the existence of regular burial grounds to be correct.

We may assume that not too far from the regular camping grounds a spot commanding a good view was selected for depositing the remains of the dead, but it still remains an open question whether they carried the corpses to such places in order to burn them there, or whether they cremated on the place of death, and carried the ashes to the regular burial ground, where they were interred in the manner described by Peron.

Braim's statement, above referred to, seems to indicate that the bodies were carried to the burial ground;

but I feel inclined to think that this view is not correct. We know that the Aborigines shirked all kind of labour, and carrying a corpse, perhaps for some miles to the nearest burial place, would mean a good deal of hard work. Further, if this had been so, it would have been surprising that no such procession had ever been seen or witnessed by a European. We might perhaps assume that this was done during the night, but all accounts agree that the Aborigines had a great dislike for travelling at night, and this, coupled with their dread of the deceased, makes such an assumption very improbable.

If we consider all the evidence that has been handed over to us, together with the evidence which the Charlton burial ground affords, we can form the following view as to the disposal of dead bodies.

When a death occurred, a pile was erected, and the body cremated on the spot. Probably while the burning was going on the relatives who attended to it used to smear their faces with some of the ashes, and, after the burning had been completed, the fragments of the larger bones were used as amulets or charms, wrapped up in a piece of kangaroo skin, and worn by the relatives or friends. The remainder of the ashes were scraped together, and carried, in a kangaroo skin (?) or a basket (?)—to the nearest burial ground, where they were deposited in a shallow hole scraped in the ground by means of a sharp stone (?). After being covered with a little earth, the grass cone and bark pyramid described by Peron were erected, and the place hereafter avoided as much as possible.

It would be very interesting to know whether similar burial places exist elsewhere in Tasmania. Mrs. Burbury, of Charlton, informs me that a similar, though much more extended place, exists near Fonthill, and Mr. Henry Foster, jun., has told me that another one is found on Darlington Park. As I have not seen either of these places, it is impossible for me to venture an opinion about them, but, to judge from the description given to me, they must exactly look like the Charlton burial ground. If this be so, the fact that the Aborigines had certain places set aside for the regular disposal of their dead bodies is beyond further doubt. The only

question which has not quite been settled yet would be whether the dead would have been carried bodily to the burial ground, or only their ashes. From all we know about the habits of the Aborigines, the latter view is more probably the correct one.

It may appear that I have gone at some length in discussing a rather trifling question. The conclusions we may, however, draw from this as to earlier history of mankind are of the greatest importance. We may conclude that early man disposed of the dead bodies by cremation, and that the custom of burying the corpse is of much later date. It is therefore not to be wondered at that the remains of diluvial and pre-diluvial human beings are so extremely rare. If archaeolithic man died, his relatives disposed of his body by cremation, and only under such fortunate circumstances, when it was impossible to get hold of the corpse, which was also protected against animals, was there a chance that the remains would be preserved. The few remains of diluvial man, the famous Spy-Cro-Magnon race, have been found under circumstances which indicate that these former owners must have come to a rather sudden end while sitting in front of their cave, by being killed and covered by a sudden fall of rocks from above. If diluvial and tertiary man disposed of his dead bodies in a similar way as the Aborigines, and there is no reason to assume a different view, the old burial grounds must have long become entirely obliterated, and the same fate is certain to happen to the Tasmanian burial grounds before long.

NATIVE BURIAL GROUND, Charlton.

Dr. Noetling, Photo.

THE NATIVE QUARRY OF SYNDAL, NEAR ROSS. (PL. III. AND IV.).

By Fritz Noetling, M.A., Ph.D., etc.

(Read August 10th, 1908.)

In the monthly notices of this Society for June, July, and August, 1875, page 41, the late Mr. J. R. Scott describes the locality of a "native quarry" as follows:—

"It has long been desirable to fix upon a spot where the Aborigines obtained their flint or stone implements. I am now able to fix upon two places, viz.:—First, about 10 chains immediately in front and to the north-east of the stone hut in Stocker's Bottom, County of Somerset, Parish of Pell. The second is about one mile more to the south-west, on Lot 443, on a branch of Dismal Creek running out of Stocker's Bottom. These two places are about six miles distant from the Macquarie River."

I think the wording can only be interpreted in one way, viz., that the Aborigines obtained the rock which they used in the manufacture of their stone implements from two localities, about six miles from the Macquarie River, at a place called Stocker's Bottom. In other words, that there exists what is commonly called a "Native Quarry" at Stocker's Bottom. It is in this meaning that Stocker's Bottom has been quoted in Johnston's Geology of Tasmania and Ling Roth's Aborigines of Tasmania.

When visiting Mt. Morriston, in June, 1908, I was anxious to see this locality, but Mr. Bennett, of Mt. Morriston, informed me that the story of the native quarry at Stocker's Bottom was a myth. However, I thought it better to convince myself whether there is any truth in Scott's statement or not, and accordingly I set out, in company with Mr. Vere Poullet-Harris, and

under the guidance of a man who knew Stocker's Bottom well, who had kindly been placed at my disposal by Mr. Eustace Cameron, of Mona Vale, to hunt up the native quarry at Stocker's Bottom. It was a long and tedious ride; but we found the stone hut right enough. "Ten chains immediately in front and to the north-east" we went, but there was not a sign of an outcrop of chert or any suitable rock, not to say of a native quarry. There was only black alluvial soil. We went further—20, 30 chains, half-a-mile—no sign of a quarry. We went in a wide circle round the hut; nowhere the slightest indication of even a small fragment of chert or a native implement. This careful examination of the locality which Mr. Vere Poullet-Harris and myself made, with the assistance of a man who knew almost every inch of ground, has conclusively proved that the native quarry near the stone hut in Stocker's Bottom is a myth. We then set out to hunt for the second locality, but, except a few pieces of dark chert on the slope of a low hill, I found nothing, and it seems pretty certain that there is no quarry at the place described by Scott.

It then struck me that another interpretation might be given to Scott's statement. Can it be that he discovered some outcrops of chert, and that he only wanted to say that he discovered two localities where rock suitable for the manufacture of Aboriginal implements occurs, leaving it an open question whether the Aborigines did exploit that locality or not? This view would in some way account for this otherwise inexplicable statement. However that may be, it is certain that there exists no native quarry in Stocker's Bottom, and this locality must therefore be struck off the list of places whence the Aborigines obtained the material for the manufacture of their implements.

Though disappointed in Stocker's Bottom, I had the good luck to hear of another native quarry which had been discovered by Mr. George Hutchison, of Beaufront, on Syndal Estate. Mr. Hutchison kindly showed me the place, and I feel greatly indebted to him, because it is doubtful whether I would have found this rather remote locality without his guidance. We proceeded from the road that leads from Ross to Trefusis in an eastern direction along the wire-netted boundary

fence between Syndal and Charlton Estate, till a hut near an artificial lagoon, which is somewhat north of the boundary fence, was reached. Passing it, we eventually reached a wire-netted cross fence running north and south, and, passing through the hurdle gate, we turned towards right (south), and, following the cross fence for about a quarter of a mile, we came on the slope of a low hill right on to the quarry. The run where it occurs is known as the "Front Shelves Run."

At first it did not seem very extensive; but further examination showed that it extended for at least half-a-mile in an eastern direction. The sight is really a remarkable one, and the photographs give only a very poor idea of it. Hundreds of thousands of fragments of rock are lying about, sometimes in large heaps, sometimes more scattered. No better comparison could be made than with a road recently covered with fresh broken metal, and every one of the fragments we see has once passed through human hands.

Unfortunately, the bush is rather dense, and this made a closer geological examination impossible. A short distance towards south-east there are sandstone cliffs, in which now and then a little cave has been hollowed out. The relationship of the chert which was used for implements and the sandstone is not quite clear; neither did I see any volcanic rock close to the outcrop of the chert. As far as can be made out, the chert forms a band of about 120 feet in width and half-a-mile in length, striking almost due east-west. Perhaps a closer examination will reveal more with regard to the geological features. For the present it is impossible to say anything more in particular with regard to the origin of the chert, whether it is metamorphosed or an original sedimentary rock. The extremely fine bedding would almost suggest that it is a true siliceous shale.

At the western part the chert is of dark blue colour, and of very fine grain; it is very evenly striated, and darker and lighter-coloured bands are irregularly alternating. At the eastern end, however, a chert of light greyish colour occurs. It would be interesting to see the passage of the dark blue into the grey chert; but I am afraid this is impossible without a good deal of digging and blasting. However, this occurrence proves

that there is no fundamental difference between the dark blue and the grey chert. It seems that this chert breaks up into irregular lumps of varying size, which are covered with brownish crust. These lumps have been broken by the Aborigines into irregular angular fragments, most of which were rejected; but suitable pieces were worked then and there into implements, while others were apparently taken to the camping grounds. All the specimens that have been handled by the Aborigines are covered with a whitish patina, which sometimes, particularly at the angles, wears off, disclosing the dark black colour of the rock.

It is very remarkable that only a small number of implements were found that show a considerable amount of chipping. Though there is an enormous number of angular fragments, I think that hardly one in a thousand is extensively worked. And there is another notable fact, all the specimens, which show either a well-worked indical face or careful trimming of the edges, invariably show a nice smooth pollical face. I already dwelt on this peculiar fact in my description of the Native Quarry on Coal Hill (Melton-Mowbray), and I can only account for this in one way. The quarries were not working places—they were quarries pure and simple—that is to say, places from which the stone used for implements was obtained. The Aborigines visited these places simply to obtain a supply of suitable flakes, most of which they took away in order to shape them at their camping grounds. Had they made their implements at the quarry, we might certainly expect a large number of unfinished rejects or broken specimens.

Another fact struck me also as very remarkable, and I may say that this equally applies to the Coal Hill Quarry. In my search for well worked specimens, I naturally turned over and examined a large number of fragments, and numerous of these seemed by size, shape, and sharp edges conveniently suitable for a cutting implement; yet they were apparently rejected. On the other hand, specimens which are well worked and trimmed appear to be much less suitable than the rejected fragments.

I already noticed, at the June meeting of this Society, a similar fact when describing the nucleus and the flakes struck therefrom; flakes that were very suitable were disregarded, and at last one, which does not appear to have more advantages than the others, was obtained, and further work was stopped. One can only wonder at the enormous waste of labour, and, as all the lower races are notoriously lazy, it is astonishing to note that they must have spent a vast amount of their labour in vain. It is very difficult to give a satisfactory explanation of this unquestionable fact; I can only suppose that every time when an Aborigine required an implement he wished it to be of a certain size. He commenced striking off flakes till one of the desired size was obtained, disregarding all the others that fell off, however suitable they might otherwise have been, because they did not have the size, or perhaps better said, the required weight. It cannot be the shape, because all Tasmanian implements are true amorpholithes—that is to say, devoid of all intentional form. It can therefore only be the size or the weight of the desired flake that came into consideration. If this view be correct, it would certainly account in a satisfactory way for the otherwise puzzling fact that numerous flakes which are evidently suitable for implements have been rejected, while others less suitable have been worked into implements.

At present a fairly thick bush grows all over the quarry, and the traces of a great bush fire are still visible. These bush fires had a remarkable result on some of the fragments; a large number are superficially cracked; as a further result, irregular splinters break off, and the originally smooth surface assumes a rough, jagged appearance. I have a most striking example of this action of the fire in a well-chipped specimen, from which a number of splinters have already been detached, while others are ready to break off at the slightest shock. It is obvious that if this specimen had been exposed for a longer time to the action of fire and rain, the originally well-chipped archaeolithe would have changed into an angular fragment, devoid of any signs of working, but perhaps showing still the cracks produced by fire.

In conclusion, it is advisable to give a revised list of the native quarries known up to date (2). These are—

1. A quarry on Coal Hill (1), near Melton-Mowbray (Johnstone's Quarry)—(Noetling, The Native Quarry on Coal Hill, near Melton-Mowbray, The Tasmanian Naturalist, 1907, Vol. I., No. 2, pp. 14-19). Chert-quarry.

2. Small quarry near the railway station of Pontville. Porcellanite-quarry. (Weston's Quarry.)

3. Quarry on Front-shelves run, Syndal Estate, near Ross. Chert-quarry. (Hutchison's Quarry.)

4. Quarry on the boundary line between Glenleith and Charles Hope Estates, River Plenty, about 2 miles from Plenty railway station. Chert-quarry. Walker's Quarry.) (H. Ling Roth, The Aborigines of Tasmania, 2nd edition, 1899, p. 149.)

5. Quarry in the neighbourhood of the Great Lake, between Split Rock and the western shore of the Great Lake, according to the late Mr. Scott. This place is quoted in Johnson's Geology and in Ling Roth's Aborigines of Tasmania. Mr. Harold Bisdee has also mentioned to me that a quarry exists near the Great Lake, but whether this is the same locality as that mentioned by Scott I am unable to say.

6. It is certain that the Aborigines used the Breccia, which occurs in large, loose boulders on the beach of Droughty Point for their implements, though there is no regular quarry. The numerous implements picked up

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(1) Only a few days ago Mr. R. V. Nicholls, of Melton-Mowbray, kindly informed me that he had found another quarry, about four miles to the west of the railway station. I have just seen this locality, and I can fully confirm Mr. Nicholls' discovery. The quarry is the largest and most extended I have hitherto seen, and I will describe it in a subsequent paper. I may only mention here that it is a chert-quarry, in which the treasured kind of grey chert was obtained. As there are now two quarries near Melton-Mowbray, and as the locality where this quarry is situated has no particular name, I propose to call it Nicholls' quarry, in honour of its discoverer, in order to distinguish it from the quarry on Coal Hill, which I now distinguish under the name of Johnstone's quarry.

(2) The number of quarries having increased, I think it advisable to distinguish each by a special name. Geographical names not being always suitable, I think it will be best to name the quarry after its discoverer.

on Droughty Point are, however, of the same kind of rock as occurs on the beach.

7. A quarry is said to exist on the road from Campbell Town to Swansea, near Lake Leak. As I have not visited this place, I am unable to say whether this is correct or not.

8. Hunter's Hill, Native Point, on the South Esk, near Perth. The name implies that it must have been a favourite resort of the natives. If I am right, Mr. Johnston has first discovered this place, but it does not appear to have been a regular quarry.

9. Pipe Clay Lagoon, South Arm (Johnston, Geology of Tasmania). Though there is no doubt as to the occurrence of metamorphosed rock, I do not think there exists a regular quarry.

10. On the Tamar River (Johnston, Geology of Tasmania). Nothing is known to me about this locality.

11. Mount Communication, Saltwater River, Tasman's Peninsula (2). (Clark's Quarry.)

Out of this number we may take it that Nos. 1-5 and 11 are regular quarries—that is to say, localities frequented by the Aborigines, perhaps for a long space of time, in order to obtain suitable fragments of rock to be shaped into implements.

The locality near Droughty Point is not a regular quarry in the meaning of those above mentioned; it is very probable that Nos. 8, 9, 10 come under the same heading, though, not having seen these localities myself, I do not wish to express an opinion.

No. 7, the quarry near Lake Leak, will have to be included in the list of regular quarries, provided that the information is correct. I therefore leave it as doubtful for the present, but I hope that later on I shall be able to give more information about it. There are therefore up to date (November, 1908) seven places known in Tasmania which have been habitually frequented by the Aborigines in order to obtain the material for their stone implements.

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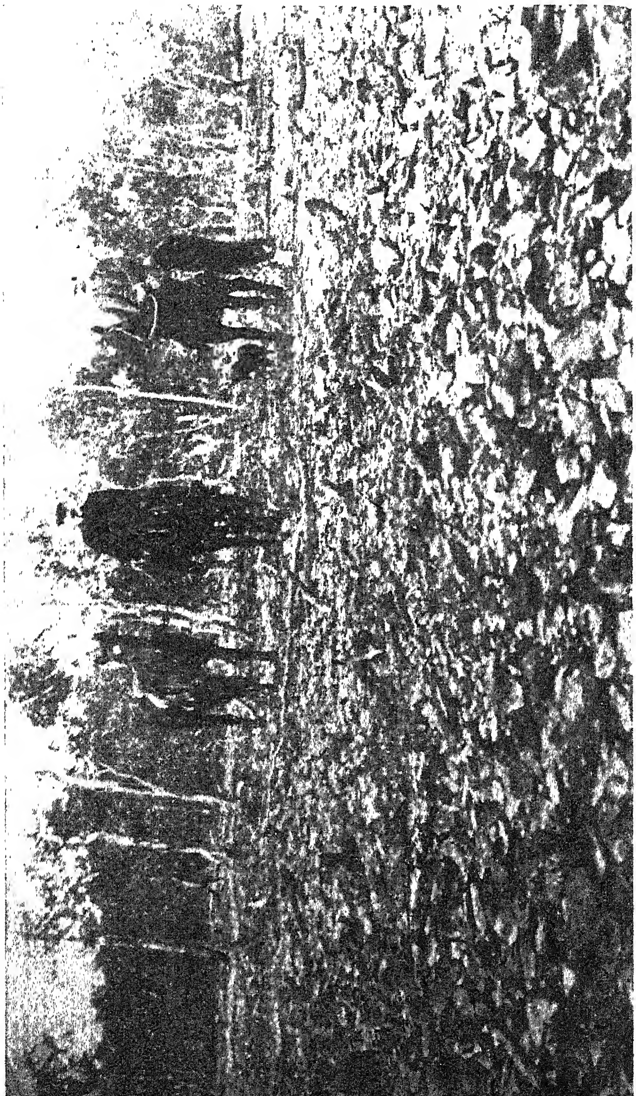
(2) Since the above was written I have been able to examine this quarry, which is situated in a very remote place. Mr. George Clark kindly showed me the place, and I am greatly indebted to him for guiding me. I will describe this quarry, together with Nicholls' quarry, but I may mention here that it is of the chert type.

Roy. Soc Tasm. 1908. Pl. III.



NATIVE QUARRY, Syndal.

Dr. Noetling, Photo.

NATIVE QUARRY, Syndal.

Dr. Noetling, Photo.

ADDITIONS TO THE TASMANIA MOLLUSCAN FAUNA. (PL. VI.).

By W. L. May.

(Read 14th September, 1908.)

Since the publication of Tate and May's Revised Census, in 1901, a considerable number of species new to the Tasmanian molluscan fauna have become known to me, and I think it is well to place the names on record. I also offer observations on several species, and take the opportunity to describe and figure what appear to be three species new to science. This paper does not in any way refer to the large mass of new material lately dredged off Cape Pillar by C. Hedley and myself.

List of new records, with habitat and remarks:—

FASCINUS TYPICUS (Hedley).—One juvenile example taken on the beach at Pirate Bay, and identified by the author, Coll. W. L. M.

MARGINELLA ANGASI (Brazier).—This has long been known to local collectors, but has been confused with M. simsoni (Tate and May). If I have rightly identified the species, then M. halli (Prit. and Gat.) is a synonym.

TEREBRA INCONSPICUA (Prit. and Gatliff).—One specimen. Storm Bay, 23 fathoms.

CLATHURELLA BICOLOR (Angas).—Not uncommon in Frederick Henry Bay.

TARANIS EDWINI (Brazier), Clathurella.—One specimen. Very similar to T. minuta (T. W.) in general appearance, but distinguished by its punctate pullus, which in minuta is spirally lirate. Daphnella mimica (Sowb.) is a synonym of the latter.

DAPHNELLA CASSANDRA (Hedley).—Derwent Estuary. Many specimens.

MITROMORPHA PALLIDULA (Hedley), Storm Bay.—Fred. Henry Bay. Rare.

NATICA SHOREHAMI (Prit. and Gatliff), Storm Bay, 24 fathoms.—One example.

SCALA VALIDA (Verco).—One living example, off Pilot Station, Derwent. Several fragmentary, from Fred. Henry Bay, in shell sand.

CINGULINA DIAPHANA (Verco).—Three examples. Various southern localities, in dredgings.

LITORINA PRAETERMISSA (May).—N. S.

RISELLOPSIS MUTABILIS (May).—N. S.

CYCLOSTREMA BASDOWI (Gatliff).—One example, Fred. Henry Bay, which seems a slight variety of this species.

SCISSURELLA ROSEA (Hedley).—Fred. Henry Bay. Several examples.

SCISSURELLA ORNATA (May)—N. S.

GADINEA ANGASI (Dall).—East and North Coasts. Rare.

GARI KENYONIANA (Prit. and Gatliff), Tellina.—Two valves, on beach at Adventure Bay. Coll. W. L. M.

CIRCE ANGASI (Smith).—Several valves. Storm Bay, 24 fathoms.

CUNA CONCENTRICA (Hedley).—Storm Bay, 24 fathoms. One valve.

CONDYLOCARDIA PROJECTA (Hedley).—Fred. Henry Bay. One valve.

CONDYLOCARDIA CRASSICOSTA (Bernard), Fig. 6.—This species was described from New Zealand, and is an interesting addition to our list. Under the belief that it was new, a figure was prepared by Miss West, which is here inserted for the benefit of Australian students. A few specimens taken in Frederick Henry Bay.

PHILIPPIELLA RUBRA (Hedley).—Many localities in the south.

MYTILUS CANALICULUS (Martyn), Universal Conchologist, 1784, Pl. 78. Latus (Chem), non Lamarck. Tasmanicus, Tenison-Woods. This novel synonymy is the result of a careful examination of our larger Mytilus, showing that the very large form named Tasmanicus, by Woods, is not conspecific with M. planulatus (Lamarck), but is identical with the New Zealand species M. canaliculus, which is distinguished—besides some difference in outline—by strong teeth in the hinge at the apex of the shell, and which are quite wanting in M. planulatus. The habitat is peculiar, it being nearly always found in deep water, and is occasionally obtained by scallop dredgers in the Derwent. I once saw two specimens attached to a tidal rock, Fred. Henry Bay, and also possess a fine example taken on the beach at Marion Bay, East Coast.

AURICULA DYERIANA (Tenison-Woods).—I now possess one of the type lot of the above species. In Tate and May it is made a synonym of Cassidula zonata (H. and A. Adams), but from a study of C. Hedley's figure of that species, in P. L. Soc., New South Wales, 1905, p. 537, Pl. XXXIII., Fig. 30, and also from Port Jackson specimens I now have, I find they are quite distinct. I also find that A. dyeriana is an absolute synonym of Cassidula nucleus (Mart). As this is a tropical species, it is very unlikely to occur here, and Mr. Dyer told me that after taking the type lot he could never find it again, although he searched very carefully. I therefore consider it to have been an accidental introduction, and that the name should be expunged from our list.—Sandford, July, 1908.

In the Records of Australian Museum, Vol. IV., No. 7, 25th August, 1902, H. L. Kesteven erected a new genus, Risellopsis, for Hutton's Fossarina varia. I now describe a second species, which is quite distinct from Hutton's, whilst still fulfilling the conditions necessary to place it in the genus.

RISELLOPSIS MUTABILIS (May), Figs. 1 and 2.—Shell depressed of three whorls, rapidly increasing, umbilicate; aperture large, descending in front, angular above; suture somewhat canaliculate. Two prominent keels divide the shell into a superior, a peripheral, and basal area. The lower keel is considerably the stronger. There is a low ridge on the base of the shell, and beyond it a small, sharp keel, exactly defining the umbilical area, which latter is whitish, whilst the rest of the shell is a dull purplish black. Lip sharp and simple, somewhat angled by the persistence of the peripheral keels, which, however, have become nearly obsolete. Columella arched, and slightly expanded over the umbilicus, which is ample and perspective. Shell almost smooth (often corroded), but very finely striated by lines of growth. Height, 2½; greatest diameter, 3½ mill. Habitat.—Most of my specimens, including the type, are from Fred. Henry Bay, Tasmania. It occurs in Victoria also (C. Gabriel, F. H. Baker).

Individuals may vary, by the keels—especially the upper one—becoming almost obsolete, giving the whorls a more rounded appearance. One example is highly turretted, giving it a trochiform appearance. Another has the last whorl partly detached. The colour may also become reddish, mottled with white, or there may be yellowish patches on a black ground. From the New Zealand species (R. varia), it differs in being less round and without the keels on the base and upper part of the whorl, and in wanting the coarse striation. Type to be placed in the Tasmanian Museum, Figs. 1 and 2.

The following note on the Genus Litorina was communicated by my friend, Charles Hedley, of the Australian Museum, Sydney, whom I also have to thank for kind assistance in the preparation of this paper.

"LITORINA (Menke), 1828, non Littorina Ferussac 1822), nomen nudum. Ferussac (Tabl. Syst. des Anim. Moll., 1822, p. xxxiv.), casually wrote Litto-

NOTE.—This species was wrongly figured in Tate and May's Census, Pl. xxiii., fig. 9, as Fossarina Funiculata Tenison-Woods.

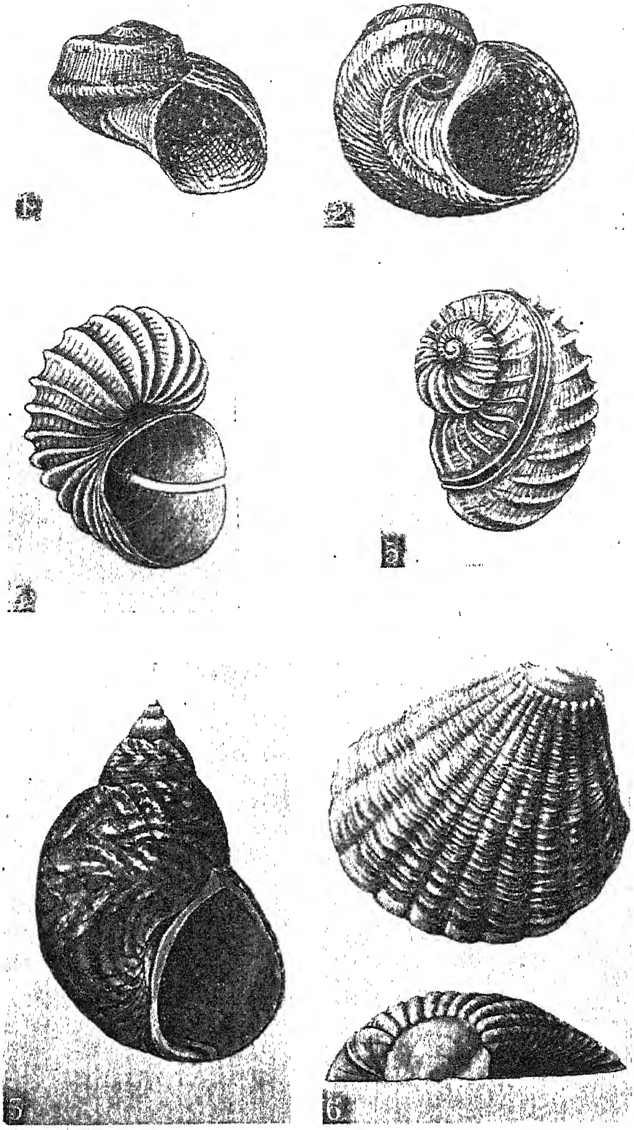
rina among a long list of genera without giving a type definition or other means of identification; his name must therefore be discarded as a nomen nudum. Then Menke (Syn. Meth. Moll., 1828) introduced Litorina with a classified list of species, their synonyms, and references to literature. It is on Menke's work that the genus is based. I have not access to his first edition, but in the second edition (1830) the genus is given on p. 44."

LITORINA PRAETERMISSA (May), N. S., Fig. 3. —Shell globosely turbinate, umbilicate; whorls, six rounded, rapidly increasing, the last very large; mouth pyriform, columella arched, flattened, and expanded over a narrow but deep umbilicus, which is frequently covered, and so not a constant feature. The interior varies from light to dark purplish-brown; umbilical area white. Operculum sub-spiral. Within the anterior end of the columella is a pale band, margined by narrow dark lines. The whole shell is girt with fine spiral impressed lines—about 12 on the penultimate—and strongly and frequently very coarsely ridged by lines of growth. Ground colour greenish white; the purplish-brown colour pattern varies considerably in different examples, but usually consists of undulating and zigzag bands more or less broken up. The apical whorls are brown—lighter towards the top. Very variable in size. Dimensions of the type:—Length, 15; breadth, 11 mill. Figure 3. It differs from L. Mauritiana (Lamarck) chiefly in the globose form and colour markings, which seem very constant, but is connected by the impressed spirals and light band in the mouth. It was listed by Tenison-Woods in his census as L. undulata (Gray), and perhaps comes nearest to L. cincta (Quoy and Gaim.), from New Zealand. Habitat.—Widely distributed, and in the same positions as L. mauritiana, but not so universally present as that species. Type to be placed in the Tasmanian Museum.

SCISSURELLA ORNATA (May), N. S., Figs. 4 and 5. —Shell minute, obliquely discoidal, strongly ribbed and spiralled; whorls rounded, but somewhat angled by the canal; mouth large, roundish, oval, and a small

but deep umbilicus. The canal forms a deep furrow, bordered by sharp, raised edges, the whole raised on a distinct ridge, which surrounds the shell about midway between the suture and the periphery; on the lower side there is a smooth, depressed area. The strong sharp ribs begin below this area, and continue round the whorl to enter the umbilicus. Above the furrow raised curved ribs roughly correspond to those below; they continue uninterrupted from the central ridge to the suture. The spaces between these ribs are cancellated by six to eight spiral keels, much smaller than the ribs, and not passing over them. These spirals continue between the lower ribs, passing over the upper part of them, there giving them a crested appearance. All these spirals are irregularly spaced. The apex of 1½ turns is squared by a beaded ridge, and is sunken below the level of the adult whorls. The mouth is well defined by a continuous narrow margin; the slit is open, deep, and of moderate width. Whorls two, exclusive of the apex. Colour, yellowish white. Greatest diameter, 1½; least, 1¼; height, 1 mill. Habitat:—Frederick Henry Bay; a few specimens in kelp roots. It has a superficial resemblance to Schismope beddomei (Petterd), but the ribs are more numerous and continuous, and with strong spirals, and it is a larger shell, and a true Scissurella. Scissurella coronata (Watson), Challenger report, page 114, seems a near ally. Figs. 4 and 5. Type in Tasmanian Museum.

Roy. Soc. Tasm. 1908. Pl. VI.



1, 2. RISELLOPSIS MUTABILIS, May.
3. LITORINA PRÆTERMISSA, May.
4, 5. SCISSURELLA ORNATA, May.
6. CONDYLOCARDIA CRASSICOSTA, Bernard

THE ABORIGINAL DESIGNATIONS FOR STONE IMPLEMENTS.

By Fritz Noetling, M.A., Ph.D., etc.

(Read October 12th, 1908.)

Quite in the commencement of my studies of the stone implements manufactured by the Tasmanian Aborigines, I noticed that the Southern tribes had a special word for that particular rock which is generally, though wrongly, called "Black Flint." Considering the popular, though wrong, use of the word "Flint," by which the word originally applied to the rock from which a stone implement is made is used to designate the implement made therefrom, the question naturally arose whether this particular native word meant the implement or the substance (rock) from which it was made. At the first glance this seems immaterial and hair-splitting; but on closer examination it will be seen that the question is a most important one. If this particular word is only used to describe a special implement, it would conclusively prove that the Aborigines intentionally manufactured implements of a certain shape, which they distinguished by a special name from all the others. If, on the other hand, this word represented the designation of a particular kind of rock only, the above inference cannot hold good, and the conclusions derived from the morphological study of the implements—namely, that they are devoid of all intentional shape—is fully confirmed.

The vocabulary of Aboriginal words is, unfortunately, very limited. Calder (1), whose compilation is

(1) Language and Dialects spoken by the Aborigines of Tasmania. Parliamentary Papers, 1901. No. 69.

probably the most comprehensive, does not enumerate more than 1135 words, some of which are unquestionably adopted (2). It is more than probable to assume that, however limited the vocabulary of Aborigines may have been, a fair number of words have not been handed over to us. However that may be, a combination of the results of mineralogical and morphological studies, together with a careful examination of the vocabulary, has led to some very interesting results.

In the first instance, however incomplete the vocabulary may be, it is certain that the Tasmanian language had no special word for some of the most important implements in the economic life of the human race. These implements are:—

1. Knife.
2. Axe or Hatchet.
3. Saw.

To which we may add

4. Bow.
5. Arrow.
6. Spear or Lance Head.

It may be taken as granted that the Tasmanian language had no distinguishing words for the above-mentioned six implements. Consequently it is certain that the civilisation of the Tasmanian Aborigines did not know these implements, because, if it had, there would have certainly been words to designate them, and if such words had existed we would find them in the vocabulary, because it is improbable to assume that those who compiled the vocabulary of the Aborigines could have overlooked the words for these all-important implements had they existed and been used by the Aborigines.

Scott, who was probably the first who made a study of the Tasmanian Archaeolithes, designates them as follows (3):—

Flint or a knife = teroona, trawootta.

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(2) For instance it is obvious that the Tasmanian word "backalow" or "bacala" for bullock is derived from the English, considering that no cattle existed in Tasmania previous to the arrival of the Europeans.

(3) Letter on the Stone Implements of the Tasmanian Aborigines. Papers and Proceedings, Royal Society of Tasmania, for 1873-1874, page 24.

Plain and simple as this appears, it is by no means so. In what sense is the word "flint" used? Does it mean to express the mineral flint, or does it mean an object made from flint? I think that the latter view is the correct one, because Scott adds, "or a knife."

We may therefore conclude that any cutting implement manufactured by the Aborigines was called

teroona or trawootta.

At the first glance it might appear that these are two absolutely different words, but I shall be able to prove that they are practically the same.

If we look up Milligan's vocabulary of the Tasmanian language, we find under the heading of flint the following words:—

Tribes about Mt. Royal, Bruni Island, Recherche Bay, and the South of Tasmania—North-West and Western Tribes.

Mungara (Flint).

Mora trona (Flint), black.

Tribes from Oyster Bay to Pittwater—

Trowutta (Flint).

It is obvious that the words trawootta (Scott) and trowutta (Milligan) are identical. We have, therefore, the following words to designate the Tasmanian stone implements:—

1. Trowutta.
2. Teroona.
3. Mungara.
4. Mora trona (black flint).

It is evident that the word "trona" is exactly the same as "teroona," and, if we write the word trowutta like this—

trowa-tta

we see that we have apparently the same root, because it can be taken as certain that the words

Teroona,
Trona,
Trowa,

are the same. The different spelling may be due to dialects or other reasons, but the main fact that they are identical remains.

"Black" flint is designated as "mora trona," and, of course, if "mora" would mean "black," the interpretation would be quite simple. But this does not seem quite certain.

Milligan states that the eastern tribes used the word "mawback" or "mawbanna," the southern tribes the word "loaparte" for black, and, though there is perhaps a certain likeness between "mora" and "mawbanna," I would not consider this as an established fact. However that may be, we have therefore a—

1. Trona (teroona),
2. Mora trona,
3. Trona-tta (trowutta).

If my interpretation be correct, the rock or the mineral from which the implements are manufactured was called

Trona (=teroona=trowa),

and a special kind of this rock, the fine-grained, dark blue, or black variety, was called "mora trona."

The implements manufactured from this "trona" were called

trona-tta=trowa-tta, and, if my interpretation is correct, the suffix "tta" or "ta" means "made from" or "manufactured from."

There still remains the word

Mungara,

as used by the Southern tribes. For the present I am unable to offer an explanation for this word, which, for all we know, may be only a corrupted mora trona.

So far everything seems plain enough, but Ling Roth publishes a vocabulary compiled by the Rev. Norman, in which neither the word "flint" nor "knife" is mentioned. But under the heading "stone" the following words are enumerated:—

1. Teewartear.
2. Larnar.
3. Peurar.
4. Noeenar.

It is a peculiarity of this vocabulary that almost all the words end either "er" or "ar," and that, though the spelling is very curious, the first word is no other than the word "trowutta," of Scott and Milligan. We have therefore the well-known word for stone implement; but, besides this, three new words, of which it is impossible to say whether they may mean different types of implements or different varieties of rocks.

Now, if we refer to Ling Roth's second vocabulary, Appendix B, we find under the heading "a stone" the following words:—

1. Loine (Dove, Jorgen-Jorgensen, and Brain).
2. Lenn-parena (Gaimard).
3. Peoora (Scott).
4. Nannee (Dove, Jorgen-Jorgensen, and Brain).
5. Nami (M'Geary).
6. Loine (Peron).
7. Lennicarpeny (Dove, Jorgen-Jorgensen, and Brain).
8. Longa (dO).

That is to say, quite a number of words, among which we can only identify "peoora" with Norman's "peurar." As it is, however, certain that "loine" and "loine," as well as "nami" and "nannee," and "lenn-parena" and "lenni-carpeny" are identical, the above list is reduced to four new words, and we would therefore have, including Normans three new words, seven words for "a" stone.

A reference to Milligan's vocabulary proves, however, that this list is less formidable than it appears. Under the heading "stone" he gives the following words:—

Tribes about Mount Royal, Bruni Island, Recherche Bay, and the South of Tasmania—North-West and Western Tribes.

Loinah, Louna, or Loine, Noanyale.

Tribes from Oyster Bay to Pittwater..

Loantennina.

This proves that the words

Loinah, loine, loine, louna, longa,

and probably also larnar, are identical, and simply meant a stone of any kind in the dialect of the Southern tribes.

Further, it may be taken as pretty certain that the words

Loan-tennina,
Lenn-parenna,
Leni-carpeny,

are identical, and that these words meant "a stone" in the dialect of the Eastern tribes. The relationship between this word and the word "loina" is unquestionable, inasmuch as "loan," "lenn," "leni" represent probably the same word. Could we prove that in the dialect of the North-West and Western tribes the "l" is turned into "n," the word "noanyale" would more correctly spell "loanyale," and therefore contain the same root, "loan" or "loina," as the other words.

We have therefore ten words, viz.:—

1. Loine.
2. Loiné.
3. Loinah.
4. Louna.
5. Longa.
6. Larnar.
7. Loan-tennina.
8. Lenn-parenna.
9. Leni-carpeny.
10. Loan (noan)-yale.

There can be no doubt that the first six words are identical, and simply mean a stone (of any kind). It is difficult to say whether the last four words have the same general meaning as "loinah." To me it seems more probable that they represent certain kinds of rocks. We know that the Aborigines called freestone "poningalee." The iron glance from which they made the red ochre was called "latta-winne," and the red ochre was "lalla-winne." These composite words seem to prove that the four words above-mentioned represent certain kinds of rocks, and this view is generally strengthened

by the fact that in the word for freestone the last word, "galee," is the same as that in l(n)oan-yale. The most conspicuous rock of Tasmania, even more so than the freestone, is the Diabas, and, if there existed a word for freestone, it is more than probable that there was also a word for Diabas, and that one of these four words stands for Diabas. Next to the Diabas comes the mudstone, and for the Eastern tribes the granite. If freestone was "ponin-galee," is it too rash to assume that the closely-connected mudstone was "l(n)oan-galee (yale)"? The other words stand either for Diabas or for Diabas and granite.

There remain, therefore, three words—

1. Peurar = peoora,
2. Nannee = nami,
3. Noeena(r).

If we consider the very different spelling of Norman's words, I only need to refer to a comparison of the words teewartear (Norman) and trawutta (Milligan and others). It is not very improbable that the word "noeena(r)" really means "loina," and, if we further consider what has above been said about the change of the letter "l" into an "n," the words "nannee" and "nami" originally spelt "lannee" and "lami." These last two words have therefore most probably to be included under the above list, meaning nothing else but "a stone."

We have therefore arrived at a probable very accurate view as to the meaning of all these words except the word

Peurar = peoora.

Mr. Ritz has kindly told me that in his opinion this word should represent something spherical. In many languages, as Mr. Ritz tells me, the "bll" or "pll" means something round or spherical (1). There is no doubt that the word "peura" can be pronounced in such a way as to closely resemble the primitive root, and I think that Mr. Ritz's suggestion is probably correct. We can practically divide the whole group of Tasmanian implements into two classes—the chipped tronattas and the spherical pebbles—represented by the

(1) For instance the word "ball."

sacred stones. It is not only probable, but pretty certain, that the water-worn, rounded-off pebbles, which were turned into sacred stones, were distinguished by a different word from the ordinary tronatta, and Mr. Ritz's hypothesis comes probably very near the truth.

The result of these somewhat lengthy considerations may be condensed as follows:—

The words

1. Loine, loine, loinah, louna, longa, larnar, noeenar mean a stone (of any kind).
2. Loan-tennina, lenn-parenna, leni-carpeny, noan-yale probably represent special kinds of rocks, such as granite or Diabas.
3. Peurar, peora probably means a pebble, perhaps a sacred stone.
4. Trona, teroona is the word for the rock from which an implement is made.
5. Mora trona means a peculiar variety of trona, distinguished by a bluish black colour and a fine conchoidal fracture.
6. Tronatta, trowutta, trawootta, teewartear is the name for the implements which were manufactured from trona or mora trona.
7. Mungara, meaning unknown; perhaps corrupted from mora trona.

The main and most important result of this investigation is the establishment of the fact that the Tasmanian language knew perhaps two, but most probably only one, word for the implements which were produced by working certain classes of siliceous rocks.

I particularly wish to point out that the fact is fully corroborated by the results of the morphological examination of the tronattas. These examinations proved that the tronatta is a kind of universal implement which was indiscriminately used for chopping, cutting, scraping, boring, and hammering. The Aborigines did not manufacture an implement which, for instance, solely and exclusively served the purposes of a knife, or a chopper, or a scraper. Any suitable fragment of rock could be used for any of these actions above-mentioned, and we must take it as granted that the Aborigines never manufactured special implements to serve special purposes only.

ON DR. NOETLING'S CONCLUSIONS RESPECTING THE ABORIGINAL DESIGNATIONS FOR STONE IMPLEMENTS.

By Hermann B. Ritz, M.A.

(Read October 12th, 1908.)

Dr. Noetling's conclusions are that—

(a) There were two classes of stone utensils—one consisting of round, water-worn stones, called pe-ura, and used for religious ceremonies; the other of chipped, sharpened stones, called by various names, and used for cutting;

(b) The Aborigines had perhaps two words, but probably only one, for siliceous implements;

(c) The Aborigines did not manufacture special implements for special purposes.

The arguments he adduces from the aboriginal vocabulary are so cogent that his conclusions are almost inevitable. It seems to me that only some of the details are arguable, and I shall confine myself to these.

When we investigate the language of the Aborigines we meet at the outset with serious difficulties. In the first place, the records are very meagre, and then, even these were made by men who had no special training in philology. Still, a careful collation of the vocabularies will enable us to arrive at a greater amount of positive knowledge than would at first be suspected.

Subject to correction, I would conclude from my investigation that—

(a) The number of words in the aboriginal vocabulary is very small—much smaller than the lists drawn up by Calder, Milligan, Ling Roth, and others would lead one to expect;

(b) Many words, apparently different, are really identical;

(c) The apparent differences are due to a faculty the Tasmanians seem to have had, in common with the South Sea Islanders—namely, that of interchanging the members of certain sound groups, for instance, the liquids "l," "m," "n," "r;" and, again, the dentals "t" and "n" and "l."

(d) The vowels seem to have been particularly subject to variation. Of course, this phenomenon is, like the one just mentioned, also found in the Indo-European languages.

These points are illustrated by the evidence adduced by Dr. Noetling, and we may now proceed to the discussion of his paper.

He states that the aboriginal vocabulary contains no word for knife, axe, saw, bow, arrow, spear-head. I could not find any of these myself, for the word for spear-point—poyeena, poyeenta—bears a remarkable likeness to the English "point"—perhaps, in the former case especially, assimilated to "pe-na," an aboriginal word, to which we shall refer again.

Still, there are words for "gun" or "musket"—"le rina," "le langta," "pawleena" (pawl-lina); but these, when dissected, mean simply "swift weapon," "long or far-reaching weapon," "round or powerful weapon." Indeed, it is these very words that gave me what I think is the clue that will enable us to find a way out of the apparent confusion of the aboriginal vocabulary.

Next, Dr. Noetling discusses the word "trowatta," which denotes a chipped implement. It consists of two parts—"tro" and "atta." He offers the conjecture that "tta" is analogous to the "t" in ama-t-us (Lat.), ly-t-os (Gr.), gelieb-t (Ger.), love-d (Eng.), and denotes something finished or made. The abruptly-ending sound of "t" would seem to support this view.

On the other hand, when we examine the vocabulary, we find the "t" or "n" (with the Oceanic epithetic vowel, in practically all the nouns. For instance,

we have liem-e-na and lim-ete (abscess), lie-ta and ne-na (sharp), like a knife; thus, "atta" may be a mere noun-suffix, though even then it might indicate a state of completion.

This leaves "tro" to account for. Dr. Noetling conjectures it to mean rock or stone.

I agree with this, but would go further back—viz., to "hard," as we have "tera-na," "teri-na" for bone, "tra-mu-ta" a pebble, rolled quartz, where "mu" is perhaps round, as in "ma-bea," to turn round (with verbal suffix "bea"). "Teru-na," a cutting flint, and "tro-na," flint, seem to be forms of the same word. Thus "trow-atta" would mean a hard thing finished (by chipping).

In "mora trona" (black flint) we have "mora," not black, but heavy; thus, the heavy, hard thing.

"Mungara" presents some difficulties. It might be a compound of "muna" and "ga-ra." Now, "muna" means wood, fog, therefore, perhaps, dense, solid, and is very near to "mura" (heavy). "Ga-ra" may have affinity with the second part of "ponin gale" (freestone), "noan yale" (mudstone), where "ponin" may be connected with "pona," white (cloud), while we find "noan" to be the western equivalent of "loina" (stone), or, rather, sharp instrument. "Gale" or "yale" may be connected with "ya-na" (teeth), the natural knives.

We mentioned the cognates "lie-ta" and "ne-na" as meaning "sharp cutting." The significant part is "li" or "ne." This we find again in the following words for "stone," mentioned by Dr. Noetling:—"Loi-ne," "le-nni," "na-nni," "noan gale," and we may strengthen the conjecture of the identity of "li" and "ni" by some analogous cases. We find the following words for "woman"—"lowa," "loa-le," "noa-lia," "nowa-lia;" for "bird," "lae-re-ne," "nia-rana," "nie-ri-na;" for "swift," "lung-a-na," "mung-a-na" (to fly like a bird); "lang-a-na," "lag-a-na," "dog-na (foot); "nung-a-na" (boat), for "running thing;" "lug-a-na" (river water); "nug-e-tena (rain, with double suffix to indicate multitude of drops); "nug-a-ra" (drink).

We find "li" or "ni" also in the form "ri. We have "li-e-na," "le-na," "re-na" (kangaroo); "re-na" (water rat); "re-ne" (to run); "li-a" (water); "li" (weapon).

All these meanings are comprised in swift or speedy. An edged stone will be speedier in its work as a tool than a blunt one, and the characteristic of a living animal, a running stream, a boat, a foot, a bird, is motion.

I agree with Dr. Noetling that "loan-tennina," "lenni-parenna," and "leni-carpeny" are words of the same meaning. Analysing them, we find the first parts, "loan," "lenni," and "leni," meaning "stone suitable for sharpening." Stones seem to have had no meaning and no name except in so far as they were found useful. "Tennina" may be akin to "tenine" (a finger or toe-nail), "something that scratches." "Parenna" seems to be a form of "pe-re-na," where "pe" would mean "pointed, sharp," as in "pe-na" (a lance or spear), and "re" would be "cutting." "Carpenny" may be composed of "kaw" (teeth), "pe" (sharp), and the suffix "ny" or "ne."

The round stone, presumed to have been used for religious ceremonies, was called "pe-ura." The explanation of this word is specially difficult, as we do not know the exact pronunciation of it. If the "r" is harshly trilled—as it evidently was when the recorders wrote the same word as "prena" and "perina," "trona" and "teruna"—it is quite possible that "peura" was but another form of "palla" (round), as we find it in "pala" (sun, star), "pala" (man), "pula-tula" (eye), "pulbena" (frog), perhaps a bull-frog, "poira" (round shell). This presents a suggestive analogy with "ball," "bull-et," "bowl," "bill-et," "pill," "barrel," "pear," "berry," "apple," "malum."

Another conjecture is that "peura" is a form of "pe-una," where "pe" would have the meaning of to hurt from "pena" (spear), and "una" means fire. In support of this we have "mungara puna" (scar), such as would be caused by wounds inflicted during religious ceremonies, and cauterised to preserve the marks, and at the same time prevent mortification. Of conjectures there is no end, but there is at any rate a beginning;

and in the dissection of the aboriniginal words and the collation of their parts, a scientific process is begun which may lead to more satisfactory results than are attainable to-day. Conjectures there must be, for we cannot seek unless we know what we hope to find.

In conclusion, I desire to lay stress on the fact that the available records are in a very unsystematic form. As a curious illustration, I would mention the translation of the first chapter of Genesis, attributed to Mr. Thos. Wilkinson. Ling Roth's book gives a very different rendering from that contained in the J. B. Walker Memorial volume, although G. W. Walker's MS. Journal is quoted; and, again, even that quotation is different from its counterpart in the Memorial volume.

Further, not only does Ling Roth mention some records which have apparently disappeared—viz., those of Wilkinson and Sterling—but it is quite probable that other manuscripts exist which are of no other than sentimental value to the present possessors, and would no doubt be obtainable for transcription. If the Royal Society were to make a public appeal for the gift or loan of such records, some valuable material might be saved from oblivion.

I would finally mention that I have heard that there exist some phonographic records of the actual aboriginal speech; if these could be found, they would be of the greatest value. As far as I am able to advance the study of that speech I shall do my utmost, and feel confident that the Royal Society will encourage my efforts.

AN INTRODUCTION TO THE STUDY OF THE ABORIGINAL SPEECH OF TASMANIA.

By Hermann B. Ritz, M.A.

(Read November 16, 1908.)

As far as I am aware, the work done hitherto with regard to philological studies of the Tasmanian language has not been extensive. Ling Roth gives in an Appendix to his book on "The Aborigines of Tasmania" an apparently full bibliography of the subject. Among the works mentioned there as dealing with the Speech of the Aboriginals, we find the following:—

CALDER.—Language of the Aborigines of Tasmania.

JORGENSEN.—The Aboriginal Languages of Tasmania.

LATHAM.—Elements of Comparative Philology.

MILLIGAN.—Vocabulary of the Dialects of some of the Aboriginal Tribes of Tasmania.

MILLIGAN.—On the Dialects and Languages of the Aboriginal Tribes of Tasmania, and on their Manners and Customs.

MULLER.—Grundriss der Sprachwissenschaft.

J. B. WALKER.—Notes on the Aborigines of Tasmania, extracted from the manuscript Journals of G. W. Walker.

There are, besides, vocabularies by Norman, Dove, Braim, Cook, Gaimard, La Billardiere, McGeary, Peron, Roberts, Scott.

Ling Roth has evidently made use of all these sources of information, and embodied the result of his researches in his book; but though very valuable for its suggestiveness, his work is not that of a trained philologist, and it will be necessary to verify and re-examine his references.

In Appendix F, he states:—"As all the vocabularies handed down to us are English-Tasmanian, and none are Tasmanian-English, it was suggested to make a compilation of one Tasmanian-English vocabulary from all the vocabularies. The initiative is due to Mrs. E. B. Tylor. In preparing this vocabulary, I have attempted to simplify the spelling as follows, where I have felt that I could safely do so without impairing the integrity of the word."

Then follow the phonetic letters proposed to be employed. They are, as far as the vowels are concerned, analogous to the Italian "u," "i," "e," "ia." "C guttural" is to be written as "k." No other letters are mentioned. Duplicated consonants are simplified, and "th," "ch" are to be left unchanged, being doubtful.

When we examine this Tasmanian-English vocabulary we observe that—

1. There are words in it not contained in the English-Tasmanian vocabularies given in the same book. For instance, "abri," arm; "arpu," yes. It would seem that Ling Roth used other vocabularies as well, or else did not give the whole of the vocabularies he names; or permitted misprints to remain. He quotes "alree" for "arm," from Dove's list. How is a reader to know whether "alree" or "abri" is a misprint? At all events, this work will have to be done over again.

2. There are many words taken from the French vocabularies, in which the French phonetic spelling is retained, instead of being transliterated according to Italian phonetics.

In Appendix C we find Milligan's vocabulary of various tribes. This, apart from some printer's errors, is almost, but not quite, identical with that quoted by Calder in the Parliamentary Paper which Sir Elliott Lewis caused to be compiled in 1901. Here, again, verification is necessary.

A curious discrepancy exists in connection with portions of the Book of Genesis, translated by Thos. Wilkinson at Flinders Island in 1833. One specimen of it is given by Ling Roth in Appendix D; another is in the J. B. Walker Memorial Volume, and is evidently an extract from Geo. W. Walker's Journal.

Now, we should expect transcripts of the same text to be practically identical; but these two specimens differ essentially from each other.

In the first place, the spelling is quite different. A few examples will suffice to show this: Walker gives "pomleh" for "made;" Ling Roth, "pomable." Walker gives for "darkness" "lywerreh;" Ling Roth, "lewara." For "said," Walker gives "kany," Ling Roth "carne."

Walker states that Thos. Wilkinson translated three chapters of Genesis, and also composed a considerable vocabulary of words. If the rest of the translation and that vocabulary could be found, they would be most serviceable for the study of the language.

In Appendix E, Ling Roth transcribes fairly accurately the "Popular Song" from Walker's Journal, and refers, for the purpose of comparison, to a version of the same "song" by Milligan, in Appendix C, but overlooks the version quoted by himself in Appendix D, from Davies.

These three versions of the same song are very interesting, and may prove very important.

To compare small things with great, we might notice the curious analogy with the Rosetta stone, and its inscription in three languages, which enabled Champollion and Young to find the key to the hieroglyphics of Egypt; and also with the trilingual rock inscriptions at Behistan, which led Rawlinson to discover the secret of reading the ancient languages of Persia, Babylon, and Assyria.

Of course, our own task is not so difficult, nor is its importance so great; still, the trilingual record of the same meaning should lead us to some definite result in our quiet backwater of human life.

Let us then compare the three versions of our song, and see what conclusions we can deduce from them. Omitting mere repetitions, as not pertinent to our present purpose, we quote from Ling Roth:—

Milligan's version:—Pappela rayna 'ngonyna; toka mengha leah; lugha mengha leah; nena taypa rayna poonyna, nena nawra pewillah, pallah nawra pewillah; pellawah!

Davies' version:—Ne popila raina pogana; thu me gunnea; thoga me gunnea; naina thaipa raina pogana; nara paara, poivella paara; ballahoo! Hoo!

G. W. Walker's version:—Poppyla-renung, onnyna; temingannya, lemingannya; taukummingannya; nyna tepe rena ponnyna; nyna nara pewilly para; nara pewilly pallawoo!

This version is slightly different in the Memorial Volume:—Instead of temingannya we have lemingannya. It is probable that temingannya is a misprint for lemingannya, or vice versa.

On analogy with the rest of the song, it is more likely that lemingannya should be repeated than that another word, however similar, should be used. Still, temingannya will also give an appropriate sense; and we shall refer to it again in that light.

For convenience of reference, we shall denote Milligan's version by M., Davies' version by D., and Walker's by W.

Looking at the whole text, we at once notice that practically all the words end in "a," "ah," "na," or "ne." We may safely assume that these endings have no essential meaning, whatever meaning they may have had originally. We find the same phenomena in many other languages. For instance, the ending "a" indicates the feminine gender in all the languages of the Indo-European family; "s" is most commonly the sign of the masculine gender, as we find it, e.g., in Aeneas, dominus, eques, visus; in "res," etc., the "s" is really borrowed from the masculine nouns, and the word is akin to mensa.

In Icelandic, we have a still more striking instance in the addition of the sound "r" to nouns and adjectives; in verbs this is softened to "a." We have, comparing the Icelandic words with their English equivalents, kongr for king, hundr for hound, vikingr for viking, grar for gray, langr for long, blindr for blind.

To get at the chief meaning of the words, therefore, we must cut off these excrescences; but this must be done judiciously, for we may not know at first whether in rayna, for example, the "n" belongs to the root or to the ending.

Our merit in trilingual interpretation is very much diminished by the fact that we possess already fairly complete lists of the words used by the Aborigines. We are not to expect in their case a vocabulary as copious as that of a race far more remote from the "simple life," and the words we have are, comparatively speaking, quite numerous enough to supply all the needs of communication that may have been felt by the primitive minds of our predecessors. The word "predecessor" is singularly appropriate in this connection. It means "One who has stepped down before," "One who has pre-deceased," "One who has done before our time what ourselves shall have to do before long—that is, stepped down from the eminence of being the lord of all he surveys."

Now, Milligan tells us that our song was sung in praise of a great chief, one who has been high in power and glory, and has stepped down and is now forgotten. The very fact that this song was, as Walker tells us, used by all the Aboriginal tribes, must have had a melancholy interest for the temporary recipient of the honour, if ever he realised that, after all, he was not the very first in power and glory.

From these hints, we may conclude that the song probably indicated the reasons for conferring special honour on a man. Now, in their simple lives, there was not much scope for the display of excellence; their needs were few, consisting almost exclusively of food and protection against enemies; and the best man would be who was best able to procure plenty of food, and security in the peaceful enjoyment of it. Their hero

would be a man strong of body and swift of foot and arm; and the song in his honour would lay stress on these qualities, and express admiration for their possessor.

Resuming our scrutiny, we find in D. the first word "ne," which does not occur in M. and W. We know that "ne-na" means "sharp;" it also means "you," and "no," and "that" (the probable meaning of the ending "na"), and "lo!" or "pay attention!"

We may take all these meanings together in the idea of "separate from me." The significant sound "n" is formed by closing the mouth and parting the lips; with the "sharp" teeth pressing on the tongue, the outer world is shut off from the speaker. As the joining of the lips inwards forms "m," and refers to the speaker as "me," so the exclusion implies the "not-me," the "you," "that," "no," the object of our attention.

We may therefore take "ne" in D. to mean Lo! The real beginning of the song is pappela, popila, poppyla. Ling Roth gives us pawpela and papla as "big," "large."

Here we notice first the reduplication of the "p," which indicates emphasis, as implying greater energy in pronouncing the initial sound of the word. Ling Roth gives several examples of this—e.g., kana, to talk; kakana, to talk loudly; mura, heavy; mumura, tree.

This leaves "pel" as the chief part, and in it we find the echo of pill, ball, and the Tasmanian palla, "man" and "sun," and peura, "round." To the Aboriginal mind, muscular development or roundness was an indition of strength; a lean man would not have the same strength as a stout one. In confirmation of this, we need only refer to the Japanese and Turkish wrestlers, who are usually very corpulent.

Thus we get for popela the meaning "very strong." We have not taken any notice of the vowels, and that for two principal reasons. In the first place, vowels in all languages are very subject to variation, and secondly, the uncertainty of the accuracy of the phonetic representation of the vowels given in our records makes it unsafe to rely on it for an argument.

The next word is given as rayna, raina, renung. In W., it is almost certain that the letters have been wrongly apportioned, for M. gives the following word as 'ngonyna, which is confirmed by gunnea in D.; so that the second word in W. should be rene, and the third, 'ngonnyna.

Thus we get in each case rene, which means "speedy," "to run."

The third word in common is 'ngonyna in M., 'ngonnyna in W., and three words farther on D. gives us gunnea. These are evidently identical with 'ngune, "fire." We note that the D. version gives words of simpler and more guttural sound than those of M. and W., so that it is quite in accord with the general character of the D. version to have gunnea as equivalent of 'ngonyna. D. alone gives here pogana, "man." We shall find other words for "man" farther on, in the three versions.

Next we have—

In M., toka mengha leah, lugha mengha leah.

In D., thu, me gunnea, thoga me gunnea.

In W., lemingannya or temingannya, taukummingannya.

To begin with, we must split up the long words in W. We get le mi 'ngannya or te mi 'ngannya, tauku mi 'ngannya.

Now, toka means "heel," and lugha, "foot."

We recognise toka again in thoga in D., in tauku in W., and in the shortened form thu in D.; while lugha appears in the short form of le in W., and toka in the same version as te, as alternative. Thus it is possible that both lemingannya and temingannya are right; at all events, the analogy between lugha, le, and toka, te is striking.

The word lia means "speedy" (like a spear).

There remain the words mengha, me, mi. In me, mi, we see the short forms of mena, meaning "I," "me," or "my;" but mengha requires further consideration. It occurs in M., and, when we turn to Milligan's

Phrases in Ling Roth, we find the explanation. There we get, in the first ten lines, the following words for "give":—tyenna, teang, teeany. From this we may deduce several conjectures.

If Milligan got those phrases from the same individual, the words were liable to variation at will, within certain limits. If he got them from individuals of the same tribe, there was the same liberty of variation given to each speaker. As Milligan published his work in 1858, he got his information perhaps at second hand, or else from the Aboriginals after their banishment from the mainland. In the latter case, tien, tian, and tiang might represent different dialects.

The variation of tian and tiang is of a type very common in various languages. A man of Flanders is in French called Flamand, and in the marshes of England, Fleming. An English chamberlain becomes in France a chambellan, and at the Vatican a camerlengo; while the Latin minus is in elegant Italian meno, and in the popular speech, mingo.

The next verse of the song is:—

In M., nena taypa rayna poonyna;

In D., naina thaipa raina pogana;

In W., nyna tepe rena ponnyna.

Ni-na is common to the three versions, though in D. it appears as nena. Ni means thou or you, and the different vowel in D. suggests that the dialect of D. bears to that of M. and W.—for these seem to be practically the same, except in the phonetic rendering—a relation analogous to that between Doric and Ionic Greek, or between North Britain and South Britain English.

Taypa, thaipa and tepe are evidently the same word, meaning "come," or, rather "here." Ta means "stop," and is an echo of the "thud" heard when one thing strikes against another. In pa or pe we recognise the word of denoting "activity;" pe-na means "spear," the symbol of effective activity, and the syllable be or pe is characteristic of verbs—i.e., words of activity.

Rayna, raina, rene we know already.

Pogana, in D., we know to mean "man."

Poonyna or ponnyna means "bird," literally active, speedy, as ni, like li and ri, means "moving."

The next line is—

In M., nena nawra pewillah, pallah nawra pewillah, pellawah.

In D., nara para poivella para; ballahoo! Hoo!

In W., nyna nara pewilly para; nara pewilly, pallawoo.

Nena, nyna, we know. Nawra, nara means "he," "that one," "the man."

Pewillah, poivella, pewilly, are evidently forms of the same word, and are connected in meaning, if not in derivation, with pallah, para, pellawah, pallawoo, ballahoo; all mean "man."

Ling Roth misprints poivella for powella.

Pe means "active;" wila means "wood," therefore "hard," "tough," "strong;" so that pewila would denote one who was active and capable of resistance, and therefore "a man in his strength." Palla is either, as we have noted before, "round," and therefore "strong," or it is an abbreviation of pewilla—unless, indeed, the latter is an enlargement of palla, by the insertion of the syllable we, which is akin to pe and be, and means "active," and may therefore be used to indicate emphasis. We find such "infixes" frequently in other languages, from "induperator" for "imperator" in Lucretius, to the very modern "In the Sweet (in the sweet) By-and-by."

Thus pallawoo would be just a variant of pawila, with the additional emphasis of the final "hoot," which is repeated in D. as Hoo!

The only remaining word is para, and this is in all probability a variant of palla; the interchange of liquid consonants, "l" and "r," "m" and "n" is a very common phenomena everywhere. For instance, many Chinese will pronounce ring as ling.

Thus we have accounted for every word of the song —truly, I hope, plausibly at all events.

We have yet to establish the meaning of the groups —that is, we have to explain the sentences.

The key to this meaning is contained in the "Phrases" quoted by Ling Roth from Milligan and others.

In these phrases, we observe that there is no sign of any accidence. The words seem invariable in form and widely applicable in meaning, as we have already seen. The order of the words, supplemented, probably, by gestures, would define the exact meaning.

In this respect, we find an interesting parallel in the syntax of the Chinese language. We cannot now enter into this subject, except so far as to give a few specimens.

Take the sentence, "I will not give you any water."

Milligan gives for this:—Noia meahteeang meena neeto linah; literally, "Not me give you stop water." In the Chinese Mandarin speech, the sentence would be:—Ngo moo ki, ki gni shoey; literally, "Me not give give you water."

In Milligan, the group meahteeang meena is interesting; it is, taking the roots only, mi tien mi, and seems analogous with "he gives," where "he" and the final "s" in "gives" have the same meaning. The Indirect Object is expressed in different ways. In Tasmanian we say "you stop," that is, "my giving stops at you." In Chinese, we use the word "give" itself as the index of the object to whom any action applies. "I sing to you" would be rendered "me sing, give you" (the benefit).

We may now proceed with our own English version of the song in its three forms:—

M. is literally,—mighty, run, fire, heel, my, speedy, foot, my, speedy, thou, come, run, bird, thou, very, great man, man, very, great man, hero!

In plain English, "With might runs the bush fire; my heel, too, is speedy, and my foot is swift. Come thou, and run with the speed of a bird! Thou art a real warrior, a man indeed, a warrior, a hero!"

D. would be, in plain language, "Lo! with might runs the man; my heel is swift like fire, my heel indeed is swift like fire. Come thou and run like a man; a very man, a great man, a man who is a hero! Hurrah!"

W. is in meaning a combination of M. and D., thus:—"With might runs the fire; my heel is like fire, my foot is like fire; come thou, run like a bird; thou art indeed a great man; a man indeed, a great man, a hero! Hurrah!"

Milligan says that these verses were sung as an accompaniment to a native dance, in honour of a great chief.

This explanation was very helpful in my search after the meaning of the song. The rhythm is clearly marked, and the repetitions are very suggestive.

Walker says that this song was popular among all the Aboriginal tribes, but that he had not obtained its meaning, as it was by them involved in some mystery.

The fact that the song exists in different dialects makes it most valuable to us. It is quite probable that this song was connected with some important tribal ceremonies, and would not be willingly explained to strangers.

May it not rather have been the "Popela Song," "The Song of the Mighty One," than a "Popular Song"?

Davies says, "I cannot translate it, nor, could I do so, is the subject very select?"

This presents a charming specimen of sly humour. See how neatly he escapes any inquiry as to the meaning of the song, by suggesting that it would not be quite proper to speak of such things in polite society!

We, at all events, have avoided any impropriety in our rendering, and seem to have reconstructed one scene of the life of Old Tasmania; in imagination chiefly, and with a due sense of the defectiveness of our knowledge; but still, in the hope that we have found the way that will, in time and after arduous and sympathetic efforts, enable us to hear once more "The sound of a voice that is still."

REPORT

OF THE

ROYAL SOCIETY

OF

TASMANIA

FOR THE YEAR

1908.

Hobart.

Printed at "The Examiner" Office, Patterson Street, Launceston.

1909.

REPORT.

The Council of the Royal Society have the honour to present their Report for 1908 to the Annual General Meeting of the Society.

Nine Monthly General Meetings and one Special General Meeting were held during the year. Eleven Ordinary Meetings and four Special Meetings of the Council were held during the same period.

Twenty-seven Fellows and three Associates were elected, and fifteen Fellows allowed their membership to lapse during the same period, and the deaths of three Fellows were recorded.

Three vacancies in the Council occurred through the retirement of Mr. A. G. Webster, Colonel Legge, and the Right Rev. Dr. Mercer (Bishop of Tasmania), and were respectively filled by the election of Dr. Noetling, Mr. E. L. Piesse, and Mr. A. D. Watchorn.

On the retirement of Mr. Webster, who had been a member of the Council for thirty-nine years, and Chairman of the Council for some years past, the Council expressed their appreciation of the services rendered by him during his long connection with the Society.

At a Special General Meeting on November 25, 1908, an amendment of Rule 16 was adopted, to the effect that the annual subscription should be reduced to £1 in the case of Fellows resident more than fifteen miles from Hobart.

The following papers were read during the Session of 1908:—

Notes on a Chipped Boulder from near Kempton, by Fritz Noetling, M.A., Ph.D.

On State Borrowing and Sinking Funds for the Redemption of State Debts regarded from an Economical Point of View, by R. M. Johnston, F.L.S., I.S.O.

On a Recent Visit to the River Gordon, illustrated by lantern slides, with remarks on the need of reservation of land along the banks of the River, by J. W. Beattie.

On the Native Quarry at Syndal, near Ross, by Fritz Noetling, M.A., Ph.D.

On a Native Burial Ground at Charlton, near Ross, by Fritz Noetling, M.A., Ph.D.

Additions to the Tasmanian Molluscan Fauna, by W. L. May.

The Aboriginal Designations for Stone Implements, by Fritz Noetling, M.A., Ph.D.

On the conclusions of Dr. Noetling respecting the Aboriginal Designations of Stone Implements, by Hermann B. Ritz, M.A.

An Introduction to the Study of the Aboriginal Speech of Tasmania, by Hermann B. Ritz, M.A.

Considerable time and attention were given by the Council to the questions of the printing of the Society's Papers and Proceedings, and of the avoidance of the long delays that have occurred for some years past in the publication of authors' papers. The negotiations were finally concluded for the necessary printing, and authors' copies of all papers read before the Society have now been published and distributed.

The Society is under obligations to a Committee of Fellows, who investigated the contents of the Library, and set apart a number of duplicates and miscellaneous publications unconnected with the objects of the Royal Society, so that they should be available for exchange or sale.

A Balance-sheet, duly audited, showing the receipts and expenditure for 1908, is appended.

THE ROYAL SOCIETY OF TASMANIA.

RECEIPTS AND EXPENDITURE, 1908.

GENERAL ACCOUNT.

RECEIPTS.	£	s.	d.	EXPENDITURE.	£	s.	d.
Balance from 1907	15	9	6	Balance of Salary late Secretary	3	3	4
Subscriptions—108 Fellows	162	0	6	Secretary to the Council—Salary	50	0	0
2 Associates	1	10	0	Assistant—Wages	6	0	0
2 Fellows in advance for 1909	3	0	0	Messrs. Davies Bros.', Ltd.—Printing	57	4	0
Papers and Proceedings sold	0	7	6	"Tasmanian News"—Advertising	0	16	6
				"Daily Post"—Advertising	0	5	0
				Grant to Medical Section	12	0	0
				Insurance of Books	2	5	0
				Messrs. Lee—Use of Lantern	2	0	0
				Messrs. Tolman and Sons—Fuel	1	10	0
				Mr. Echlin—Auditor	2	2	0
				Messrs. Walch and Sons—Books, etc.	7	8	9
				Bank Charges, Exchange, etc.	0	14	3
				Petty Cash, Postage, etc.	4	15	1
				Refreshments at Monthly Meetings	1	10	0
					£151	13	11
				Balance to 1909	30	13	7
	£182	7	6		£182	7	6

LIFE COMPOSITION FEES.

	£	s.	d.		£	s.	d.
Subscription—One Life Member	15	0	0	Messrs. Whitesides—Book Cases	14	0	0
				Balance to 1909	1	0	0
	£15	0	0		£15	0	0

MORTON-ALLPORT MEMORIAL FUND.

	£	s.	d.		£	s.	d.
Interest Received from Trustee	9	5	0	Debit Balance from 1907	6	16	5
				Balance to 1909	2	8	7
	£9	5	0		£9	5	0

BERNARD SHAW, Hon. Treasurer.

Audited and found correct.

H. W. W. ECHLIN, Auditor.

ANNUAL GENERAL MEETING.

The Annual General Meeting of the Royal Society of Tasmania was held in the Society's rooms, Museum, on Friday, 5th March, 1909. In the absence of the President (His Excellency the Governor, Sir Gerald Strickland), Mr. Bernard Shaw, on the motion of Mr. T. Stephens, seconded by Dr. Butler, was voted to the chair. A fair number of Fellows were present.

RE-ELECTION OF RETIRING MEMBERS OF COUNCIL.

There being no other nominations, the retiring members of the Council for the year, Dr. Elkington and Dr. Butler, and Messrs. E. L. Piesse and A. D. Watchorn, were re-elected.

ELECTION OF FELLOWS.

The following gentlemen were elected as Fellows of the Society:—Messrs. T. M. Donovan, L.R.C.S., J. D. Miller, H. M. Sich, and W. E. Shoobridge.

ANNUAL REPORT.

The Annual Report for 1908 was read by the Secretary to the Council.

The Chairman, in moving the adoption of the Report and Balance-sheet, said, in reference to the Committee of Fellows who had investigated the Society's library, that their work had been carried out in a most thorough manner, and the proceeds derived from the sale of books would go towards the purchase of new works.

In seconding the motion, Mr. T. Stephens said that the members of the Council who had drafted the Annual Report had been unable to gain any information about the Honorary and Corresponding Members of the Society at the present time. The latest particulars that they had been able to discover were in the Annual Report for 1891. It appeared from the records that at the Annual Meeting of 1902 it was resolved that the list of Fellows and Members should be annually published, in accordance with the original practice, but no trace of such publication has yet been discovered. In reference to the balance-sheet, which had been compiled with great care by their Honorary Treasurer, Mr. Shaw, he (Mr. Stephens) might say that, if there should be a moderate increase in the number of Fellows, and nothing extravagant was done in the way of printing, there was a fair prospect of the possibility of making a general reduction in the amount of the annual subscription at the end of the current year.

The motion was put to the vote and carried.

REPORTS OF SECTIONS.

The Report of the Medical Section was received, and read. It dealt with the progress of the medical branch during the year, and stated that its establishment had gone a long way towards creating a feeling of harmony in the medical ranks. Its popularity was evinced by the ever-increasing membership. Several new works had been added to the library, bringing it up to a most efficient stage. The ordinary meetings had all been well attended, and the members one and all evinced great interest in the Society.

On the motion of Mr. Stephens, it was resolved, "That the usual grant of £12 to the Medical Section of the Society for the purchase of medical works be continued for the current year."

APPOINTMENT OF AUDITOR.

Mr. Echlin was re-appointed Auditor, and the meeting closed.

LIST OF FELLOWS AND ASSOCIATES

OF THE

ROYAL SOCIETY OF TASMANIA.

* Fellows who have contributed Papers read before the Society.
† Life Members.
The Addresses of Members residing in Hobart are omitted.

FELLOWS:

AGNEW, L. E., MRS.
ALLWORK, F., L.S.A., New Norfolk.
ARCHER, WM. HENRY DAVIES, Longford.
ANDERSON, G. M., M.B., C.M., Franklin.
ARMSTRONG, HUGH, F.R.C.S.
ASH, PERCY.
ATKINS, W. A.

†BARING, REV. F. H., Orford.
†BAKER, HENRY D.
BARCLAY, DAVID.
*BEATTIE, J. W.
BENNETT, WM. HENRY, Ross.
BIDENCOPE, JOSEPH.
BRAIN, REV. ALFRED, M.A.
BROWNELL, F. LESLIE, New Town.
BURGESS, HON. WM. HENRY.
BUTLER, ARTHUR, Lower Sandy Bay.
BUTLER, FRANCIS.
BUTLER, HON. GAMALIEL HENRY, M.R.C.S., M.L.C.
BENNISON, THOMAS.

CAMPBELL, R. D., M.B.
*CLARKE, ARTHUR H., M.R.C.S.
CLARKE, REV. GEORGE, Moonah.
COUNSEL, EDWARD ALBERT.
CROSBY, HON. WILLIAM, M.L.C.
CROUCH, ERNEST J., M.R.C.S.
CRUICKSHANK, JAMES H., LT.-COL. R.E., Glenorchy.
CROWTHER, EDWARD L., M.D.

DAVIES, HON. JOHN GEORGE, M.H.A., New Town.
DAVIES, HON. CHARLES ELLIS, M.L.C.
DECHAINEAUX, L.
De HOGHTON, CAPT. THOMAS, R.N., Pontville.
DELANY, HIS GRACE ARCHBISHOP.
DOBBIE, EDWARD D., Sandy Bay.
*DOBSON, HON. HENRY.

*ELKINGTON, JOHN S. C., M.D.
ERNST-CARROLL, F. J., M.Sc., Neuchatel, Switzerland
EVANS, L. A.
EVANS, THOMAS MAY, New Town.
EWING, HON. NORMAN K.

†FOSTER, HENRY D.
†FOSTER, JOHN D.
FINLAY, W. A.

†GRANT, C. W.
GIBLIN, LYNDHURST, M.A.
GIBLIN, W. W.
GOULD, ROBERT, Longford.
*GREEN, A. O., Bellerive.
GOULD, H. T.

HARRISON, E. J., Bellerive.
HARRISON, MALCOLM.
HARVEY, WALTER A., M.R.C.S., M.B.
HEYER, REV. J., M.A.
HOGG, G. H., M.D., Launceston.
HORNE, WILLIAM.

IRELAND, E. W. J., M.B., C.M.

*JOHNSON, J. A., M.A.
*JOHNSTON, ROBERT M., F.L.S., I.S.O.

KERR, GEORGE.
*KINGSMILL, HENRY C., M.A.
KNIGHT, H. W., Sandy Bay.

*LEGGE, VINCENT W., COL., R.A., Cullenswood.
LEWIS, MAJOR R. C.
LEWIS, HON. NEIL ELLIOTT, D.C.L., M.A., K.C.M.G., New Town.
LINES, D. H. E., M.B.
LODDER, MISS M., St. Helen's.
LORD, F. W.
LOVIBOND, REV. H. J., M.A.
LOVE, JOSEPH, M.B.

MASON, M.
†MITCHELL, J. G., Jericho.
*MAY, W. L., Sandford.
MILLER, LINDSAY S., M.B., Ch.B.
*MOORE, GEORGE BRETTINGHAM, C.E.
†M'CLYMONT, J., Queenborough.
*McAULAY, PROFESSOR ALEXANDER, M.A.
McELROY, J. L.

MACFARLANE, HON. JAMES, New Town.
MACGOWAN, E. T., M.B., B.S.
*MACLEOD, P. J., B.A.

NICHOLAS, GEORGE C., Ouse.
*NOETLING, FRITZ, M.A., Ph.D., Sandy Bay.
NICHOLLS, W. MINCHIN.

OLDHAM, E.

PARKER, A. C., New Town.
PARSONS, MISS S. R.
*PIESSE, E. L., B.Sc., LL.B., New Town.
PRATT, COURTNEY.
PROPSTING, HON. WM. BISPHAM, New Town.
*PETTERD, W. F., C.M.Z.S., Launceston.

RADCLIFF, HAMILTON.
REID, A. R.
*RITZ, H. B., M.A.
ROBERTS, HENRY LLEWELLYN.
*RODWAY, LEONARD, Sandy Bay.

†SPROTT, GREGORY, M.D.
†STICHT, ROBERT, Queenstown.
SCOTT, H. H., Launceston.
SCOTT, ROBERT G., M.B., C.M.
SHAW, BERNARD, I.S.O., Sandy Bay.
SHOOBRIDGE, REV. CANON GEORGE.
*SIMSON, AUGUSTUS, Launceston.
*STEPHENS, THOMAS, M.A., F.G.S.
*SPENCER, H. J.
SEAL, LEONARD P.

TARLETON, JOHN W., Sandy Bay.
*TAYLOR, A. J.
*TWELVETREES, W. H., F.G.S., Launceston.
*THOMPSON, REV. EDWARD H.

WALCH, CHARLES.
WATCHORN, ARTHUR DENISON.
WEBSTER, ALEXANDER GEORGE.
WEBSTER, C. ERNEST, Sandy Bay.
WEBSTER, GEORGE A., M.B., M.R.C.S.
*WEYMOUTH, W.
*WHITE, O. E.
WHYTE, JAMES WILKINSON, New Town.
WINTER, ALFRED.
WISE, H. J.
WOLFHAGEN, J. EDGAR, M.B., C.M.
WOLFHAGEN, WALDEMAR, New Town.

YOUNG, RUSSELL, New Town.

ASSOCIATES:

BLACK, R. A.
OSBORNE, JOHN, Junior.

PAPERS AND PROCEEDINGS

OF THE

ROYAL SOCIETY

OF

TASMANIA

FOR THE YEAR

1909.

Hobart.

Printed at "The Examiner" and "Weekly Courier" Offices,
73-75 Patterson Street, Launcest

The responsibility of the statements and opinions given in the following Papers and Discussions rests with the individual authors or speakers; the Society merely places them on record.

Royal Society of Tasmania, 1909.

Patron:

HIS MAJESTY THE KING.

President:

HIS EXCELLENCY SIR GERALD STRICKLAND, K.C.M.G., Succeeded by
HIS EXCELLENCY SIR HARRY BARRON, K.C.M.G., C.V.O.

Vice-Presidents:

T. STEPHENS, M.A., F.G.S.
R. M. JOHNSTON, F.L.S., I.S.O.

Council:

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G. A. WEBSTER, M.B.

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BERNARD SHAW, I.S.O.

Honorary Treasurer:

BERNARD SHAW, I.S.O

Secretary to the Council

ROBERT HALL.

Auditor:

H. W. W. ECHLIN.

Order of retirement from the Council in 1911:—Messrs G. E. B. Moore, T. Stephens, Bernard Shaw, Dr. Sprott

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PAPERS.

Royal Society of Tasmania.

ABSTRACT OF PROCEEDINGS.

APRIL, 1909.

The General Meeting of the Society was postponed for a month.

MAY 3, 1909.

The Monthly General Meeting of the Society was held at the Museum on Monday evening, May 3, 1909.

His Excellency the Governor, Sir Gerald Strickland, K.C.M.G. (President) in the chair.

In attendance on His Excellency were Sir Charles Lucas, K.C.M.G., and Hon. A. A. Pearson, C.M.G., Dominions Department, Colonial Office, Downing-street, London.

VICE-PRESIDENTS.

The President appointed Messrs. T. Stephens, M.A., F.G.S., and R. M. Johnston, F.L.S., I.S.O., Vice-Presidents of the Society for the current year.

ELECTION OF FELLOWS.

Messrs. A. E. Blackman, F. E. Burbury, W. Burn, W. F. D. Butler, M.Sc., S. P. Crisp, A. R. P. Cross, T. T. Flynn, B.Sc., A. V. Giblin, W. S. Lake, M.Sc., E. M. Law, M. W. Simmons, C. E. Toovey, and L. K. Ward, B.A., B.E., were elected Fellows of the Society.

ADDRESS OF PRESIDENT.

The President delivered the following address:—

" In consequence of my absence from Tasmania on leave, a period of two years is under review, but it is remarkably devoid of great and startling discoveries. The scientific periodicals are, however, full of evidence of steady progress in the improvement of previous inventions.

The Wright Brothers achieved mechanical flight several years ago. The President of the French Republic has recently expressed his regret that the invention of a Frenchman, who was really the first to make a machine fly, had been offered to the War Office, successfully tested, and officially rejected. In the present year flying machines are being made by the hundred, and they have become a substantial factor in plans of military offence and defence. But, so far, only daring and highly-trained experts can navigate them, and the difficulties of starting and

alighting make them as yet unsuitable for purposes of exploration. They are also unable to carry any considerable weight. On the other hand, the dirigible balloon has been brought to such a degree of perfection that the carrying of a dozen men and several tons of stores is merely a question of money.

When it is remembered that the unexplored portion of Tasmania is very large, that the mineral belt which probably contains many a mine of the value of Lyell or Bischoff is most difficult of access by land, I feel the time is approaching when an enterprising Government may seriously consider the hiring of a dirigible balloon to carry out preliminary aerial surveys, and facilitate and encourage the subsequent work of prospectors following the ordinary methods.

At the time of my last address to this Society, scientific men were justified in laughing at wireless telephony as the objective of visionaries; but the rapid achievements in practice of wireless telephony are already astounding. The human voice has been audibly transmitted without wires a distance of 200 miles. With regard to wireless telegraphy, there have been great improvements, of which the most remarkable is the development of automatic transmission up to the speed of 120 words a minute. With regard to land telegraphs, the operation of a line without repetition has been extended over 7,000 miles. Less than a year ago serious people were laughing at Mr. Henniker Heaton's advocacy of telegrams at a penny a word, but now, by direct overland transmission to Southern Asia, and by wireless transmission thence to the shores of Australia, the possibility of penny-a-word telegrams, or, at least, of telegrams at greatly reduced rates, has been brought within the range of practical politics.

With regard to shipping, when I last addressed you the Mauretania and the Lusitania, which have fulfilled all expectations, were considered marvellous for their size, as well as for their speed, but already ships of nearly twice their size are being built. These larger ships do not aim at a speed much above 20 knots, but it is probable that their size will offer immunity from sea sickness and a great reduction in the cost of luxurious trans-Atlantic travelling. They are being built with English capital, and will probably be propelled by an economical combination of high-pressure reciprocating engines and low-pressure turbines.

This line of development is important to Tasmania. The most enterprising shipowners have already given a warning to Melbourne and Sydney that much work will have to be done to their water-ways before really large vessels can be built for the Australian trade.

Long before any other Australian port is fit to receive them, 40,000-ton vessels may be built, able to come to Australia at 20 knots by the Cape, and if the passenger traffic should warrant the experiment, Hobart may expect to enjoy its natural claims to be the port of transhipment and coaling for the Commonwealth terminus.

The providing of mechanical aids for the rapid coaling of vessels has received successful attention at Fremantle, Western

Australia, as well as in South Africa and Japan. Even under present conditions there are vessels leaving Melbourne that could profitably be loaded down two or three feet if the depth of water allowed. If sufficient capital were expended to provide facilities for the rapid and cheap mechanical coaling of such vessels in Hobart, Tasmanians might obtain work and profits in return for the depth of water in the Derwent.

Another practical achievement tending to lower freights in the future has been the successful test of the internal combustion engine, worked with producer gas on a scale suitable for ocean-going vessels. This invention is more remarkable for the great economy in wages of stokers, trimmers, and engineers than in the already well-known economy in fuel obtainable by using producer gas. Nevertheless some years must elapse before this system is adopted commercially to any great extent. It is suggested that the gas engines running at high velocity in one direction should produce electricity to be redeveloped by motors, reversible and adjustable, operating propellors at an efficient rate of revolution.

The control of water resources for the purpose of generating power and of irrigation is receiving all over the world the keen attention of sagacious men, eager to appropriate unearned increments now going to waste.

In countries long settled and thickly populated, riparian rights, catchment areas, and land values complicate and impede this line of progress. In a new country, rapidly developing, and gifted with high tablelands and ample rainfall, such as this State of ours, the sooner the level of lakes is raised, and new lakes are created by damming rivers, the better for the future prospects of large manufacturing development created by the application of water power.

Another possibility of the regulation of water for irrigation purposes may be illustrated by reference to the Derwent. If this river were provided with a lock this side of Bridgewater, steamers could pass freely, while the salt water would be prevented from contaminating many miles of river bank, along which fresh-water irrigation would become available.

With reference to minerals, the transmutation of metals has been achieved, or at least there is very weighty scientific authority for this assertion. Rubies and sapphires have been manufactured on a commercial scale in absolute equality with the natural stones as regards chemical composition, and mechanical tests of hardness and of refraction of light.

But it is still cheaper to mine silver than to produce it by transmutation from copper, and Tasmanian miners need have no anxiety by reason of this great discovery, even if it be all that is asserted of it. Sapphires are found in Tasmania; they are distinguished from manufactured sapphires by showing flaws and other defects, well known to those who possess genuine stones. The manufactured sapphire has the peculiar fault of being absolutely uniform and flawless. Tasmanian copper may suffer from the great development of aluminium, which is now being produced so cheaply that it has become, for a given price, a much cheaper conductor of electricity than copper.

The art of extracting minerals from refractory ores is making rapid progress. It is always an open question whether scientific results obtained in the laboratory, even on a very large scale, will prove commercially practical in the immediate future. Nevertheless, it may be taken for certain that, in a future not very remote, the success of the laboratory experiment will become the success of the enterprising capitalist, and I look forward with confidence to the future of the vast low-grade propositions on the west of Tasmania.

This Society has done much to draw attention to the need for the scientific regulation of forestry, and the economic introduction of rapid-growing timber from the Northern Hemisphere. I have taken an active interest in this movement, and I am glad to be able to congratulate Tasmania that at last the Government has made a satisfactory beginning in the direction of one of the most profitable and most necessary of State industries, namely, forestry, in a country where the State alone can at present be tempted to this form of investment at moderate compound interest.

The principal feature with regard to transportation on land is the rapid conversion of railroads from steam to electric traction. It is safe to say that in this line mechanical and technical difficulties have been overcome; it is only a question of having sufficient traffic to justify conversion financially. Sooner or later this day will come for Tasmania. It behoves the representatives of the people to guard against any wasteful alienation of the water power now belonging to the State. The running of a train on a monorail evoked widespread interest, but the risks and complications involved prevent its being a competitor with narrow gauge lines for the commercial handling of ordinary goods traffic.

The great interest taken by the Australian Government, and by Australian explorers, in the recent successful Antarctic expedition, recalls to mind that Sir John Franklin was the founder and first president of this Society. Meetings were then held at the old Government House, where Franklin Square and the Public Buildings now are. It has often been said that the value of the old site to-day more than covers the cost of the present Governor's establishment.

The Government Statistician, Mr. Robert Mackenzie Johnston, was deputed by us last year to represent Tasmania at the foundation of the celebration, in London, of the one hundredth anniversary of the Royal Geographical Society. The records of this Society contain a series of most valuable papers on geology, including the extensive and brilliant contributions of Mr. Johnston, who has also read papers on economic and statistical questions, of exceptional originality and worth. This leads one to express a hope that the Royal Society of Tasmania will continue to welcome papers on an ever-increasing variety of scientific subjects, and aspire more and more to the breadth of view of its great founder.

The opportunities before this Society are very promising; there is a yearning in a community such as this for a common meeting-ground for men of culture, who are devoted to study and research, and for those anxious to elevate their knowledge;

it is to these that the Royal Society of Tasmania can offer golden opportunities for the free exchange of ideas, for mutual assistance, and for the publication of original discoveries.

Nowadays, science advances with increasing rapidity, and the newly-discovered specialist should always be heartily welcomed, and never discouraged. May the future of the Royal Society be ever marked with the cordiality and friendship beween members, which have added joy to my term of office; may its governing body be progressive and on the alert to move with the growing demands of learning; may added membership and renewed energy make this an attractive centre to men of genius and men of leisure, to the hard-worked official, and to the rising amateur, and may the splendid work accomplished by the establishment of these useful rooms, of this noble museum, and of this valuable library, be an incentive to yet more successful efforts."

THE FOLLOWING PAPERS WERE READ:

(1) Records of Tasmanian Botanists. By J. H. Maiden, F.L.S., Director of the Botanic Gardens, Sydney. (Corresponding Member.)

This paper is part of a series of records relating to the several States of the Commonwealth, most of which have been already published, and is especially interesting as giving an account of the life and work of Mr. Ronald Gunn, the father of Tasmanian Botany. In addition to the memoirs of local botanists, the paper also contains notes of the work in Tasmania of men who are more properly styled Australian Botanists, among whom may be mentioned Labillardiere, Robert Brown, Backhouse, and Von Mueller.

(2) A peculiar group of Tronattas. By Fritz Noetling, M.A., Ph.D., etc.

In reference to the stone implements of the Aborigines of Tasmania, the "tronattas," the author remarks that they represent the typical archaeolithic stage somewhat modified, as noted in his first paper on the subject. Comparing them with a large collection of European specimens, he concludes that they represent the highest stage of the archaeolithic civilisation. The group of implements forming the subject of the papers and the mode of construction, are described in minute detail, and they are compared with European specimens.

(3) Red Ochre and its uses by the Aborigines of Tasmania. By Fritz Noetling, M.A., Ph.D., etc.

The author points out that the early records prove that the males smeared hair and beard with a mixture of red ochre and grease, and that he had found pieces of red iron ore at their camping grounds. He enumerates from different vocabularies the terms used in describing the process, and concludes that it was an exclusive male adornment.

JUNE 14, 1909.

The Monthly General Meeting of the Society was held at the Museum on Monday evening, June 14, 1909.

Mr. Bernard Shaw, I.S.O., in the chair.

ELECTION OF FELLOWS.

Messrs. K. Norman, LL.B., J. Black, N. K. Ewing, LL.B., A. Pedder, and A. Wertheimer, were elected Fellows of the Society.

THE FOLLOWING PAPERS WERE READ:

(1) The Minerals of Tasmania. By W. F. Petterd, C.M.Z.S.

Dr. Noetling remarked that the paper was not one that could be dealt with in detail, but it would furnish ample material for interesting discussion after being printed, and the Society was deeply indebted to Mr. Petterd for contributing so valuable a paper to its records.

(2) Tasmanian Onagraceae. By L. Rodway, Government Botanist.

The author notes the circumstance that only two genera of the family, Oenothera and Epilobium, are represented in Tasmania, and of the former only one species, which was found by Ronald Gunn near Marlborough in 1841. He describes the characteristic features of this plant, and of the six species of Epilobium, and compares them with their representatives elsewhere.

(3) The Speech of the Tasmanian Aborigines. By Hermann B. Ritz, M.A.

The author says that from a careful examination of the words and practically all the connected phrases recorded, the Tasmanian language represents the most primitive form of articulate speech, and he concludes that essentially there were only two ideas expressed by the Tasmanian language, viz., rest and motion. On this basis the whole vocabulary was probably constructed—except perhaps the purely onomato-poetic sounds—either directly or with the aid of simple metaphors. Some 600 words are quoted in support of this view, want of space and time alone hindering the adduction of at least twice as many additional examples.

After the reading of this paper, through the courtesy of Mr. Horace Watson there were given on the phonograph specimens of the songs of the Aborigines sung into the instrument by the late Mrs. Fanny Smith, a half-caste born and bred up at the Settlement on Flinders Island among the Tasmanian Aborigines.

JULY 12, 1909.

The Monthly General Meeting of the Society was held at the Museum on Monday evening, July 12, 1909.

Sir John S. Dodds, K.C.M.G., Lieutenant-Governor, in the chair.

ELECTION OF FELLOWS.

Messrs. H. R. Hutchison and G. Weindorfer were elected Fellows of the Society.

HONORARY MEMBER.

On the recommendation of the Council Lieutenant (now Sir Ernest) Shackleton was elected an Honorary Member of the Society.

Mr. Stephens said that the office of Honorary Member was restricted by their rules to persons not resident in Tasmania who had distinguished themselves as promoters of the objects of the Society and other kindred institutions, and the Council were gratified on learning from the leader of the recent Antarctic exploration that it would give him great pleasure to be associated with an institution founded by Sir John Franklin.

THE FOLLOWING PAPERS WERE READ:

(1) Notes on the occurrence of a Fossil Tree embedded in Drift on the North-West Coast of Tasmania. By T. Stephens, M.A., F.G.S.

The author describes the locality as being about half-a-mile east of the glacial drift previously described as occupying the coast line between Woody Hill and Table Cape, and states that further exploration would be required before the true relations of this comparatively recent drift and the moraine matter farther to the west could be positively determined. Specimens of the fossil wood, and of the drift in which it was embedded, were laid on the table for the inspection of Fellows.

Mr. R. M. Johnston, in the course of the discussion which followed, said that no other part of the world that he knew of was so rich in the fossil remains of forests of past ages as Tasmania.

Dr. Noetling spoke of the opalised specimens of fossilised wood, mentioning remarkable instances he had observed in India.

(2) Rocks used in the manufacture of Tronattas. By Fritz Noetling, M.A., Ph.D., etc.

The observations recorded in this paper are based on the examination of more than 5,000 tronattas, but as the important microscopical examination is still outstanding, the results are considered as preliminary only. Four classes of rocks only were used in the manufacture, viz., Chert or Hornstone, Porcellanite, Breccia, and other silicious rocks such as Chalcedony, Wood-Opal, Fossil Wood, Quartz. Volcanic rocks were never used except as hammerstones. Each class of rock is separately described, and a large number of observations regarding the specific gravity were made. The hornstone is the heaviest of all, having an average spec. grav. of 2.678, and it could be proved that 56.6 per cent. of the tronattas have a spec. grav. above 2.600; that is to say, the Tasmanian stone implement is considerably heavier than those found in Europe. A table of frequency shows that on the average tronattas were made of hornstone from 78.35 per cent., porcellanite following next with

11.93 per cent., while breccia and others form 4.78 per cent. and 4.91 per cent. respectively.

Mr. R. M. Johnston emphasised the immense amount of trouble that Dr. Noetling must have taken in preparing such voluminous notes. His admirable classification of the Tasmanian rocks used by the Aborigines would be most valuable to members of the Society and students generally. The Society was much indebted to Dr. Noetling.

NOTES AND EXHIBITS.

Mr. L. Rodway exhibited a branch of a black currant tree, which carried the winter spores of a destructive disease to black currant and gooseberry trees, called Nectria cinnibarina. The spores were distinctly visible. The summer spore, he said, is called Tuberculana vulgaris, and appears in ochre-like nodules, whilst the winter spore is in the form of bright red sacs.

AUGUST 9. 1909.

A special General Meeting of the Society was held, after due notice, at the Museum on Monday evening, August 9, 1909.

Mr. Bernard Shaw, I.S.O., in the chair.

The Chairman stated that the meeting had been convened to consider a recommendation from the Council that the last paragraph of Rule 44 should be repealed, and explained that the object of the proposed alteration of the rules was that in the interval between the courses of the ordinary Monthly Meetings of the Society an informal meeting or conversazione should be held, attended by the Fellows and their friends, at which His Excellency the President should be invited to address them on any matters connected with the objects of the Society.

The motion for repeal was carried on the voices.

The Monthly General Meeting of the Society was then held.

Mr. Bernard Shaw, I.S.O., in the chair.

ELECTION OF FELLOWS.

Messrs. Claud Clerk and E. H. Pearce, and Mrs. R. W. Fereday were elected Fellows of the Society.

THE FOLLOWING PAPERS WERE READ:

(1) On the applications of Multenions to Metageometry. By Professor Alex. McAulay, M.A.

In the absence of Professor McAulay, Mr. E. L. Piesse gave a concise explanation of the purport of this paper, and said that the researches in Multenions were a development of his previous work on Quaternions and Octonions. The properties of Multenions were first described by Professor McAulay in a paper read before the Royal Society of Edinburgh, 1907-8, entitled "Algebra after Hamilton, or Multenions." The present paper described the application of Multenions to non-Euclidean Geometry.

Owing to the difficulty of printing some of the mathematical characters used, it has not been possible to publish the paper in the Proceedings of the Society.

(2) Notes on the Names given to Minerals and Rocks by the Aborigines of Tasmania. By Fritz Noetling, M.A., Ph.D., etc.

The author gives an elaborate description of all the substances of the nature of rocks that were known to or used by the Aborigines, with a comparison of the various terms applied to them by the several tribes, and the meaning of such terms. He concludes by calling attention to the progress of the human race since archaeolithic times, as exemplified by the thousands of names by which modern science distinguishes the minerals and rocks found on our earth.

SEPTEMBER 13, 1909.

The Monthly General Meeting of the Society was held at the Museum on Monday evening, September 13, 1909.

Mr. Bernard Shaw, I.S.O., in the chair.

ELECTION OF FELLOWS.

Mr. Russell Young, jun., was elected a Fellow of the Society.

THE FOLLOWING PAPERS WERE READ:

(1) A Contribution to the Geology of Tasmania—Systematic Geology—The Pre-Cambrian. By L. Keith Ward, B.A., B.E.

The main object of the paper is to present a succinct account of the recent advances in the knowledge of the oldest rocks developed in Tasmania, their stratigraphical relationships, and their present physiographical features and distribution. The evidence upon which a Pre-Cambrian age has been assigned to the group is discussed. Some account of the lithological characters of the altered sediments is given, but the description of the igneous members of the series awaits further more detailed examination. The author notes the probability of the existence of two different horizons, the upper of which shows a greater freedom from contortion than does the lower, the two horizons being separated by an unconformity. A brief account is given of the probable origin, growth, and decay of the Pre-Cambrian rocks. The distribution of the rocks is indicated by an outline map, with a short description of the known boundaries of the areas in which these rocks outcrop. The nomenclature of Pre-Cambrian rocks in extra-Australian areas is discussed, and it is shown that the Tasmanian series belong to the Algonkian division, although no more definite classification is justifiable.

Dr. Noetling said that the paper was a valuable contribution to the literature of Tasmanian geology. All the rocks found on the surface of the earth were divided into two periods—those which had no fossil remains of creatures, and which were the earlier rocks, and those which contained such remains, and these two groups were again subdivided into different periods. The Pre-Cambrian rocks belonged to that earlier period in which there was no trace of life, and which must represent millions of years. When life first originated on the earth was not yet decided. Mr. Ward dealt with the structural features of the

Pre-Cambrian system. Those rocks had a thickness of two miles. What enormous eras of time it must have taken to deposit such a depth of rock! Mr. Ward was inclined to think that the present natural features of Tasmania were already outlined in the deposits of those Pre-Cambrian rocks. He (Dr. Noetling) thought that was rather a bold theory. Mr. Ward had taken a great deal of trouble in describing these rocks.

Mr. R. M. Johnston, I.S.O., enlarged on the paper, and stated that it was a very valuable one. It was believed that life existed on the earth prior to the Cambrian period, though we had no trace of it. The speaker dwelt on the very interesting enquiry of what has been the sequence of life on this earth.

Mr. T. Stephens said that Mr. Ward's paper was a valuable contribution to the geological literature not only of Tasmania but of the whole Commonwealth, but it could only be discussed in detail by those who had some personal knowledge of the country described. Mr. Ward remarks that the term Pre-Cambrian is merely a temporary title, and that it is probable that these rocks will eventually have to be subdivided into a number of separate systems as in North America. As an instance of one of the rocks specially mentioned in the paper, he called attention to the block of schistose conglomerate from Goat Island, near Ulverstone, now on the table, which he had placed in the Museum some two years ago, and which showed quartz pebbles drawn out and twisted under intense pressure. Mr. Stephens added that Mr. Ward's remarks to the effect that the diabase capping of most of the mountains of Tasmania was once more widely distributed, and that "it postulates a cover of sedimentary rocks since removed by sub-aerial denudation," will be welcomed by those who support the theory put forward by himself in 1892.

Mr. Lyndhurst Giblin moved that the discussion of the paper be adjourned until it had been printed, and after some debate the motion was carried.

(2) Notes on Brachycome melanocarpa, Sonder. By L. Rodway.

The author describes this daisy, specimens of which were placed on the table, and remarks that he had found it on the eastern slopes of Mount Wellington. It had been found on the mainland, but not previously in Tasmania.

NOTES AND EXHIBITS.

Mr. T. Stephens drew attention to a specimen of the fruit of the Baobab tree, from the River Limpopo, South Africa, presented to the Museum by Miss Beatrice Adams. He said that the Baobab tree was in girth the largest tree in the world, ranging from 20 to 30 feet in diameter, but not lofty. The pulp of the fruit was used for various medicinal purposes.

He also exhibited specimens of a black shaly rock containing graphite, which occurred in the bed of the River Kermandie, beyond Geeveston, and had been forwarded by Mr. James Thompson, of Hospital Bay. Whether it was pure enough to be of any commercial value has not yet been ascertained.

Rev. A. H. Mitchell exhibited a pebble of chalcedony with one side polished, and showing beautiful concentric rings. It was found at Bellerive.

OCTOBER 18, 1909.

The Monthly General Meeting of the Society was held at the Museum on *Monday evening, October 14, 1909.*

Mr. R. M. Johnston, F.L.S., I.S.O., in the chair.

Mr. T. Stephens (V.P.) reported that, in response to an invitation from the Council, His Excellency the Governor (Sir Harry Barron) had informed them that it would give him great pleasure to assume the office of President of the Royal Society.

THE FOLLOWING PAPER WAS READ:

Notes on the Glacial Beds of Freestone Bluff, near Wynyard. By Fritz Noetling, M.A., Ph.D., etc.

The author gives a historical summary of the papers which had been previously written on this interesting and important subject, and describes in detail the glacial drift and the fossiliferous sandstone of Freestone Bluff, with remarks on the basalt capping which overlies the latter. Attention is called to the intermingling of what appear to be portions of the glacial drift with the fossiliferous sandstone, evidence of which is shown by Plates illustrating the lowermost strata of Freestone Bluff. The general conclusion arrived at is that there is no sufficient evidence to prove that the glacial drift was deposited at or near the base of the Permo-Carboniferous series, and that it really belongs to the same epoch as the Turritella sandstone.

Mr. T. Stephens said that all who had any personal knowledge of the locality would be greatly interested in the new theory that had been broached by Dr. Noetling as to the probable contemporaneity of the glacial drift and the fossiliferous sandstone. For his own part he did not yet see any reason to modify the opinion expressed in a paper that had been quoted by Dr. Noetling, to the effect that the "inlayers" of drift intermingled with bands of the fossiliferous sandstone were really moraine matter that had been dislodged from the surface of the glacial drift and re-deposited at the time where the lower beds of the sandstone formation were being laid down.

The Chairman, in complimenting Dr. Noetling on the interesting and valuable paper read by him, stated that, notwithstanding the new puzzle of the interstratification of the elements of glacial erratics with what Dr. Noetling describes as "small lenticular layers of fossiliferous sandstones . . . undistinguishable from the sandstones above" (Turritella beds), he, Mr. Johnston, was still firmly of opinion that the prevailing conglomerates, unconformably underlying the Table Cape marine tertiaries, were, as originally suggested by Mr. Stephens, of truly Permo-Carboniferous age, and of the same horizon as the numerous glacial drift conglomerates everywhere abounding in the lower

beds of that age in Tasmania, notably Brown's River, Blackmans' Bay Heads (East Coast), Blackmans' Bay (near Brown's River), One Tree Point, North Bruny, and Lindisfarne. In the Derwent, notably overlying the basalts at Lindisfarne, similar conglomerates occur in lenticular patches among sandstones. The most of the harder materials in these sandstone conglomerates have been derived by disintegration and redistribution of the older glacial erratics of the adjacent Permo-Carboniferous rocks. He therefore inclined to the idea that the reconciliation of apparently conflicting evidences at Table Cape was to be found in accepting the hypothesis that two distinct conglomerate formations containing glacial erratics occur at this place. The older conglomerate is undoubtedly of Permo-Carboniferous age, the later conglomerate deriving the most of its harder materials from the disintegration of the older glacial conglomerates either at the earlier stages of the formation of the Tertiary Marine beds (Palaeogene), or towards its close. Further evidence will be necessary before this last point can be settled satisfactorily.

NOVEMBER 8, 1909.

The Monthly General Meeting of the Society was held at the Museum on Monday evening, November 8, 1909.

Mr. Bernard Shaw, I.S.O., in the chair.

ELECTION OF FELLOW.

Mr. H. Stuart Dove was elected a Fellow of the Society.

THE FOLLOWING PAPERS WERE READ;

(1) Geological Notes on the country traversed by the Derwent Valley Railway Extension. By T. Stephens, M.A., F.G.S.

The paper gives a general description of the basaltic sheet once extending continuously from Macquarie Plains to Glenora, and the occurrence in it of one of the new railway cuttings of masses of opal with traces of fossil wood. The intensely hard and brittle character of the neighbouring diabase is noted, and the evidence of its existence as an intrusive sill, or laccolite, under the sandstone formation illustrated by a Plate. The presence of numerous erratics in the neighbourhood and along the course of the new railway is mentioned, as affording evidence of glacial action in not very remote times.

Dr. Noetling said that he had long suspected glacial action in the Derwent Valley, and was glad to hear that such circumstantial evidence of it had been discovered.

Mr. Piesse remarked that other mountain ranges in Eastern Tasmania, instancing Ben Lomond and its outliers, showed unmistakable evidence of glaciation, and hoped that the matter would be more fully investigated.

(2) Points in the Morphology and Anatomy of certain Megapodes. By T. Thomson Flynn, B.Sc.

The author describes the results of his examination of specimens of two genera represented by the Scrub Turkey and the Mallee Fowl, and treats separately of the Pterylosis, or feather arrangement, and the Myology of the hind limb. The paper is illustrated by descriptive figures.

A PECULIAR GROUP OF TRONATTAS. (PLATE I., II., III.)

By Fritz Noetling, M.A., Ph.D., etc.

(Read 3rd May, 1909.)

As the Aborigines of Tasmania called their stone implements "tronatta," I think it advisable to use this word in preference to all others when speaking of them. "Tronatta" means a stone implement manufactured by the Tasmanian Aborigines, and it does not bear on the vexed question whether we have to consider these amorpholitic implements as eolithes or as archaeolithes. I may, however, add that I have no reason to alter the conclusion arrived at in my first paper, read before the Fellows of the Royal Society (1), viz., that the tronatta represents the typical archaeolithic stage in the evolution of the stone implements, somewhat modified by a considerable admixture of implements of eolithic character.

Since I commenced these researches my collection of tronattas has greatly increased. I also obtained a large collection of oligocene, miocene, and diluvial archaeolithes and eolithes from Belgium and France, and this has enabled me to fix the position of the Tasmanian tronattas somewhat more accurately in the ladder of evolution.

In none of the collections that have been sent to me are there specimens which in any way approach the high finish of some of the tronattas. On the other hand, it would be going too far to assume that those who kindly sent me these specimens included in their collection some highly finished ones, unless these were pretty common. The well-finished tronattas are by no means very common; I almost doubt whether they represent

(1) Notes on the Tasmanian Amorpholithes, Pap. and Proceed. Royal Soc. of Tas., 1906-1907, pag. 1-37.

more than 10 per cent. of the total, and the same applies very likely to the archaeolithes of Europe. Not having obtained European archaeolithes of a high finish, does not prove that they do not exist; however, if they did exist, we might expect their figures in the numerous pamphlets that have been published up to date on this subject. But here we search in vain. None of the specimens that have been figured, and they most probably do not represent the worst ones, come anywhere near to the highly finished tronatta of those groups which have been classified as choppers, scrapers, and knives. It therefore seems, that notwithstanding its eolithic element, the Tasmanian stage represents the highest stage of the archaeolithic civilisation. If this view be correct, we have at last gained that important step which has already been made with regard to the palaeolithic implements, viz., the beginning of a classification according to the skill shown in the finish of the implements.

If the Tasmanian tronatta by its finish represents the highest stage of archaeolithic civilisation, it is of great importance to ascertain its distinguishing features. This is, however, only possible by unceasing work. In the following paper I wish to describe a small group of implements which are of special interest, because they seem to have been manufactured contrary to the common rule. Mr. R. M. Johnston was the first who recognised the chief character of the tronatta. In his "Geology of Tasmania," Mr. Johnston says, page 335, as follows:—"Whatever lack of symmetry they present in facial outline, one of the faces is almost invariably smooth and flattish, without marks of chipping. . . . The direction of the blows to produce the sharp, smooth, or finely serrate edge appears to have been towards the stone and away from the original flat face."

No conciser characteristic of the tronatta could be given than this, and, though written in 1888, Herr Klaatsch, who visited Tasmania towards the end of 1906 and early in 1907, entirely disregards it, and proceeds to give a description of the characteristics of the Tasmanian implements, purporting to be his own, but practically exactly the same as that of Mr. Johnston. Considering that Herr Klaatsch did not devote more than a fortnight to the study of the tronattas, and that his own

collection is far from being representative, his pretension to give the scientific world the characteristics of the Tasmanian stone implement is rather a bold one, and it cannot be strongly enough emphasised that the credit of having first defined the characteristic features of the tronatta is due to Mr. R. M. Johnston, and not to Herr Klaatsch (1).

I have subsequently somewhat enlarged on Mr. Johnston's description, without, however, in any way altering its main features. I have shown that the smooth, flat face was the essential part of the implement, because it served as a rest for the thumb, and I accordingly called it pollical face. I therefore gave Mr. Johnston's statement a somewhat different wording by saying that the blows were directed away from the pollical face towards the indical face (1). The Tasmanian tronatta is therefore primarily an unsymmetrical implement, whose chipping is limited to one face only, viz., the indical face, which is opposite to the smooth, pollical face.

The group of implements forming the subject of this paper seems to be opposed to this rule, inasmuch as marginal chipping can be observed on both faces. At the first glance it may appear as if this class of implements forms a true transitional stage to the symmetrical palaeolithic implements wrought on both faces. More closer examination will, however, prove that there is a fundamental difference; though the marginal chipping can be observed on the indical as well as on the pollical face, it is always strictly limited to one face only—that is to say, one and the same edge is either chipped on

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(1) Though not quite so exhaustive as Mr. Johnston's, a description of the tronatta is given by Brough Smyth, Aborigines of Victoria, 1878, Vol. II., pag. 400 and 401, in which already the essential features are recognised. To whomsoever we may give the credit of having first recognised the characteristics of the tronatta, to Mr. Johnston or to Brough Smyth, it is certainly not due to Herr Klaatsch, who only repeats what others have found out long before him. This may be somewhat strong language, but is is fully justified by the circumstances.

(1) Inter lineas I may remark here that Herr Klaatsch absolutely ignores this, though my paper was read nearly a year before his own, and though I explained everything to him verbally when he visited Hobart.

the indical or on the pollical face, but it is never chipped on both faces at the same time. The fundamental difference from the palaeolithic implement, in which one and the same edge is chipped on both faces, is obvious.

Another characteristic feature of these implements is the flat, frequently smooth, indical face. In the majority of the tronattas the indical face is strongly convex; in this group it is quite flat—in fact it could be used as a pollical face—and I believe this flatness accounts for the marginal chipping not being strictly limited to the indical face. I particularly wish to point out that not a single specimen has come under notice which, having the usual convex indical face, exhibits marginal chipping on the pollical face. It is, therefore, evident, that a flat indical face which could just as well serve as pollical face was the essential condition for bi-faced marginal chipping.

This class of implements is very rare; I doubt whether it represents even 1 per cent. of the total number. In the large number of specimens I have collected there were only about 40 in all.

The finest specimen (Pl. I., fig. 1), was found at the Old Beach, and is probably uique. It is a tronatta of 74½ mm. length and 34 mm. breadth, weighing 480 grs. It is broader in the middle than at both ends; the upper one is sharply pointed, while the lower one is less so. The largest breadth is considerably below half of the length, and this gives it a peculiar leaf-shaped form, particularly as the two lateral edges are slightly convex. The pollical face, though smooth, is not quite flat, showing the wrinkles peculiar to conchoidal fracture. The indical face, though flat on the whole, is divided by a somewhat irregular longitudinal ridge, which runs close to the left side. The left edge shows the usual chipping almost from point to point, but the right edge is only chipped ot the lower half, and all working abruptly ceases just above the middle of the length. On turning to the pollical face, we see that the chipping exactly commences at that point where it ceases on the indical face, and continues to the end of the right lateral edge. Now, as the chipping of the indical face was produced by blows directed from the pollical face towards the indical face, and that of the pollical face by blows directed in the opposite way, the effect is rather a curious one.

Seen sideways, the right edge, instead of being straight, as it would have been had the chipping been carried out in one direction only, presents a peculiar broken line.

It is obvious that such a crooked edge cannot be of the slightest use, for any purposes whatsoever, and it is probably thanks to this error of the workman who manufactured it that it was preserved. The question is, how did this curious error—for error it must be—arise? I think the rather flat indical face forms the key to the solution of the problem. The Aborigine having finished the trimming of the left edge, proceeded to take the right edge in hand, and in doing so he inadvertently turned the specimen over, and, without noticing it, commenced to chip from the indical face towards the pollical face along the upper part of the right edge. Suddenly he noticed his mistake, and he at once proceeded to continue the trimming in the orthodox way—that is to say, from the pollical face towards the indical face.

There is no other way of explaining this very peculiar way of chipping, but it throws a flood of light on the mental condition of the Aborigines. To our modern mind it seems absolutely unintelligible why this useless working edge should not have been turned into an exceedingly sharp one by chipping away the indical face of the upper and the pollical face of the lower part of the right edge. The intelligence of the Tasmanian could not conceive this idea. His mind lacked the inventive genius which promotes progress. He had been accustomed to trim his implements by blows from the flat pollical face towards the the convex indical face, but it never occurred to him to make an attempt in the opposite direction, and even if he had inadvertently made a mistake he at once returned to the time-honoured fashion. Had he only continued the chipping in either direction all along the edge once the mistake had been made, he would have found what a much more efficient cutting edge he could produce by bi-faced trimming. But he did not do so, and it is almost pathetic to think that here we have a specimen which might have led to the manufacture of more efficient implements, and thus perhaps changed the fate of the whole race, had this most simple invention been made. As it has not been made, it proves that those inventions, which appear to us so simple that we are accustomed to take them as

a matter of fact, which did not require an inventive genius at all, were probably the most difficult to make, and that it required a real genius to lead mankind from the low archaeolithic to the higher palaeolithic stage.

Pl. I., fig. 2, a specimen from Melton Mowbray, measures 75 mm. in length; the breadth at the butt end is 37 mm., at the opposite end 54 mm., and its greatest thickness is 13 mm. The weight is 1,210 grs. (2¾ ounces). The lateral edges are straight, the broader edge curved, the narrower edge nearly straight. Its shape is trapezoidal, and, being broader at one end than at the other, and rather thin, it imitates in a way an axe-head. This similarity is considerably increased by the broader end being well chipped. We know, however, that the Aborigines did not possess axes provided with a handle, and it would be absurd to designate this tronatta as an axe-head. On the other hand, it is easy to see how such mistaken identifications can arise. If we knew absolutely nothing about the Aborigines, a specimen like this would without question have been declared an axe-head, though it might perhaps remained a puzzle why not only the cutting but also one of the longitudinal edges was sharpened. In this instance we know better, but the lesson with regard to the interpretation of European archaeolithes is obvious.

The pollical face is smooth and flat, but at the butt end it shows a large bulb of percussion. The right edge is almost for its whole length well chipped on the pollical face. The indical face is almost flat, and the edge of the broader end, which is slightly curved, is neatly and carefully chipped. The chipping extends even somewhat to the left lateral edge, but it does not extend far enough as to join on to the chipping of the pollical face, though it is easy to see that the result would have been the same as in the former specimen.

Pl. II., fig. 1, a specimen from Mona Vale, measures 115 mm. in length, and has a greatest breadth of 59 mm., weighing 4 ounces. At its thickest part it measures 19 mm., but for the greater part the thickness is not more than 9 mm., and even comes down to 3 mm. at one end.

The general shape is irregularly rhomboidal; one lateral edge is almost straight, and that next to it concave. The pollical face is smooth and flat, and the

right edge is well chipped all along. The indical face, though not quite so smooth as the former, is well chipped along the concave edge. The junction of the two chipped edges forms a rather sharp point, but again the chipping of both faces fails to join.

Pl. III., fig. 1, a specimen from Maryvale, measures 57 x 57 mm.; its greatest thickness does not exceed 14 mm.; its weight is 1,032 grs. (21 1-3 ounces). The general shape is nearly rhombical; two sides (the butt and opposite end) being nearly straight, the other two sides concave. The pollical face is very smooth and flat, the wrinkles of percussion being just visible. If we take the butt as the upper end (1) the right edge is well chipped, and deeply concave on the pollical face. The indical face is almost as flat as the former, but three edges are chipped—the butt edge, which has been particularly carefully trimmed, and the right lateral edge, which is again deeply concave.

Pl. III., fig. 2, a specimen from Shene, measures 71 mm. in length, and, though its greatest breadth is 44 mm., for the greater part of its length it is under 35 mm. The thickness does not exceed 9 mm., and the weight is 520 grs. (1 1-5 ounces). The general shape is elongated, broader at the butt end, one of the lateral edges straight (or even slightly convex), the other slightly concave. According to its shape, it seems well suitable for a knife or a scraper. The pollical face is flat and smooth, the wrinkles of percussion are slightly marked. Its left edge is concave, and well chipped along its whole length. The indical face is fairly smooth, but there are few longitudinal ridges as the result of flaking. The left edge very carefully trimmed.

Pl. III., fig. 3, a specimen from the mouth of the Coal River, is somewhat similar in shape to the former. It measures 58 mm. in length, and has an average breadth of 28 mm., though at one part it reaches 37 mm. The thickness is 9 mm., and its weight 365 grs. Its shape is elongated, straight at the butt end, rounded off at the opposite end. One lateral edge is straight, the

(1) I always place the specimens in such a way that the butt end represents the upper end, because it is certain that, having received the blow, it was nearest to the workman—that is to say, uppermost in its original position at the parent block.

other undulating, showing a broad, short prominence, on either side of which it is concave. The pollical face is smooth and flat, and its left edge is well chipped all along its length. The indical face is smooth, but a very conspicuous longitudinal ridge runs somewhat closer to the left edge, which is very carefully chipped; the chippings extend also over the rounded-off ends, but unfortunately the specimen is just at that point damaged where indical and pollical chipping would join.

These specimens are sufficient to illustrate the peculiar feature of this group, which in my opinion is, however, not intentional. As already pointed out, bifaced marginal trimming is only observed when the indical face is almost as smooth and flat as the pollical face. This seems to indicate that when a flake was obtained whose two faces were flat, and could therefore indiscriminately be used as the pollical face, the Aborigines made the most of it, and used both accordingly.

It is very interesting to note that similar specimens have been found in Europe. Amongst a collection of eolithes from the Mesvinien of Belgium, which has been sent to me by Dr. Rutot, of Bruxelles, I found several specimens which were used on both faces. These specimens exhibit the same feature as the Tasmanian tronattas, namely, a smooth and flat indical face, which could conveniently be used as a rest for the thumb. They are apparently more frequent among the European eolithes than among the Tasmanian tronattas, but whether this is the result of flint producing more easily two flat faces when broken than the Tasmanian hornstone (trona or mora trona), I am unable to say for the present. We might perhaps consider these implements as archaistic remnants from the times when the art of working pieces of siliceous stone was still in its very infancy. Anything to save trouble—and the shaping of a tronatta was by no means an easy matter (teste Scott!)—was resorted to, and if a flake was obtained which had two pollical faces, so to speak, it was used as long as possible.

I consider this merely a suggestion, as I am well aware that further proof would be required before this view could be further discussed.

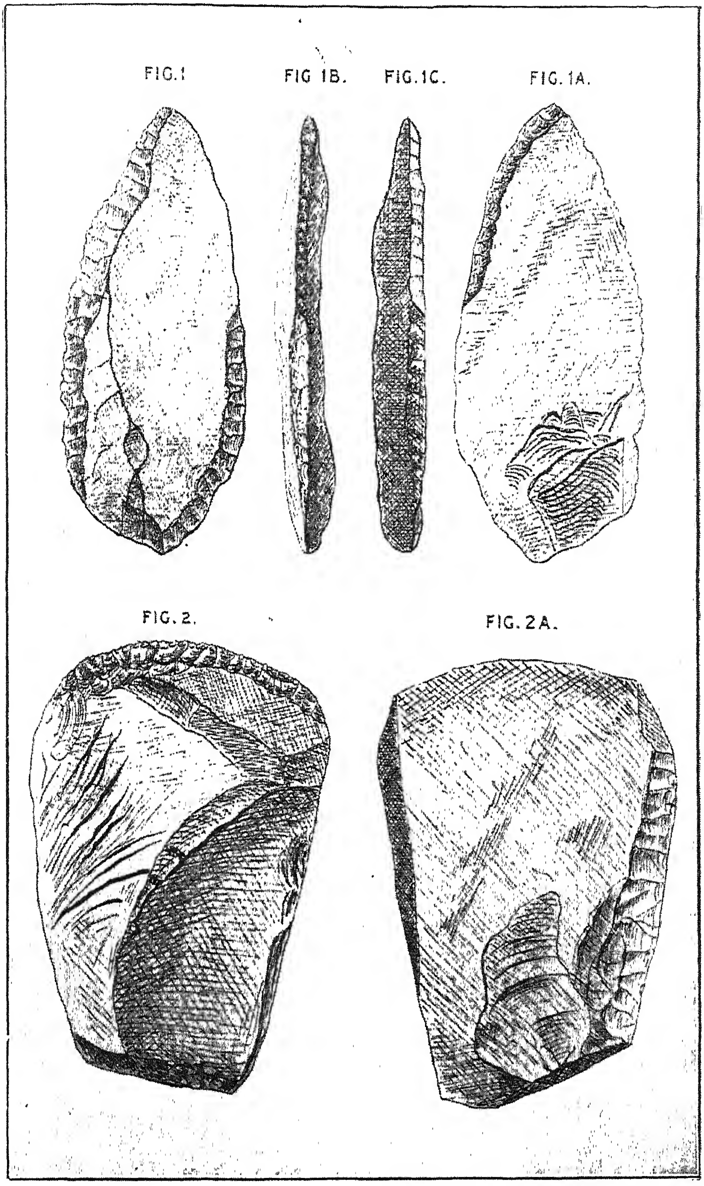


Fig. 1—Indical Face. Fig. 1A—Pollical Face. Figs. 1B and 1C—Side Views.

FIG 1.

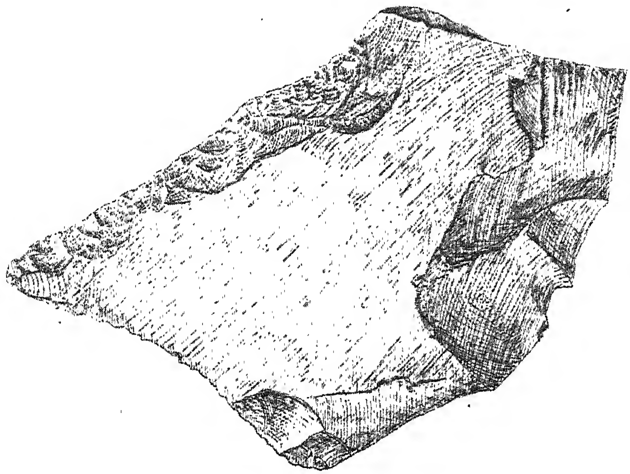


FIG. 1A.

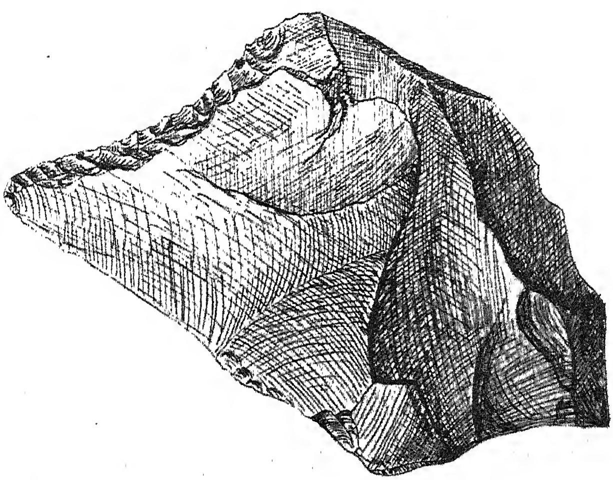


Fig. 1—Pollical Face. Fig. 1A—Indical Face.

FIG. 1.

FIG 1A.

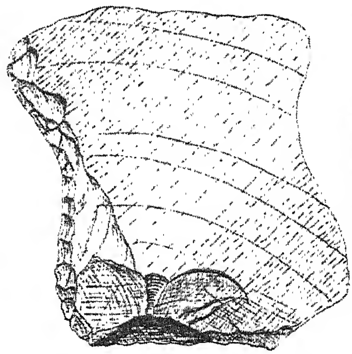


FIG. 2A.

FIG. 2.

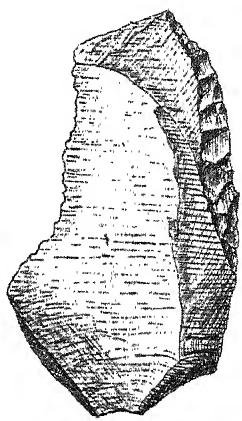


FIG. 3.

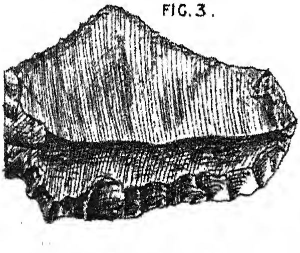
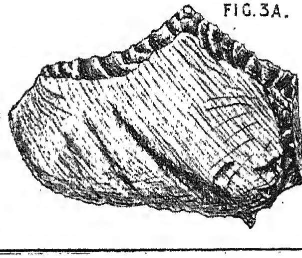


FIG. 3A.



Figs. 1. 2. 3—Indical Face. Figs. 1A, 2A, 3A—Pollical Faces.

RECORDS OF TASMANIAN BOTANISTS.

By J. H. Maiden, F.L.S.

Government Botanist and Director of the Botanic Gardens, Sydney.

Corresponding Member.

(Read May 3rd, 1909.)

I have used the term "botanists" in a somewhat wide sense, having included collectors of note, whether they described their finds or not, notable horticulturists, and, in my general list (**5**), botanists who have described Australian plants whether they visited this land or not. I have included no living man, so far as I am aware.

Some notes on South Australian botanists will be found in (**4**), of New South Wales ones in (**5**), and I am taking steps to publish my notes on the botanists of other Australian States in their respective States.

It will be seen how imperfect is the record of some who have worked amongst us, and who have not been removed by the hand of death very long.

Records of departed botanists form a branch of Australian history of practical value to working botanists. They afford a guide to their published works, and indicate where their observations were made.

The lists of species named after the various botanists and collectors are valuable (so I have often found) for tracing particulars of botanical journeys, biographical notes, and other useful information.

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Bailey, F.M.—"A Concise History of Australian Botany," "Proc. Roy. Soc., Queensland, viii. Quoted as (**1**).

Hooker, J. D.—" Introductory Essay to the Flora of Tasmania," cxii.-cxxviii. ("Outlines of the progress of Botanical discovery in Australia"). Quoted as (**2**).

Maiden, J.H.—Address of the President, Section D, Biology, Australasian Association for the Advancement of Science, Adelaide Meeting, 1907. Contains biographical notices of South Australian and some other botanists. Quoted as (**4**).

" Records of Australian Botanists—(a) General, (b) New South Wales." (" Proc. Roy. Soc.," N.S.W,. xlii., 1908.) Quoted as (**5**).

" Records of Victorian Botanists " (" Vict. Nat.," 1908, p. 101-117. Quoted as (**8**).

" Records of Western Australian Botanists " (" Journ. W.A. Nat. Hist., 1909.") Quoted as (**9**).

Britten and Boulger.—" British and Irish Botanists." Quoted as (**6**).

Mennell, Philip.—" The Dictionary of Australian Biography from the Inauguration of Responsible Government down to the Present Time " (1855-1892). London, 1892. Quoted as (**7**).

ABBOTT; FRANCIS, Jr. (1834-1903).

Born at Derby, England, 18th June, 1834; died at Hobart, 22nd November, 1903. Buried at Cornelian Bay Cemetery.

He was appointed Superintendent of Botanical Gardens, Hobart, 8th December, 1859, and was connected with them from the age of 17, having been apprenticed to his predecessor, F. W. Newman.

He was a genial, kindly man, full of practical knowledge, never more happy than when he was imparting it to others.

He was the author of the following papers in the Journal of this Society:—" The Sugar Beet," 1871, p. 31; " Thistles," 1878, p. 73; " Wild or Canadian Rice (*Zizania aquatica*)," 1878, p. 73; " Notes on New Plants introduced into the Royal Society's Gardens during 1883," 1883, p. 186; " Notes on a Recent Case of Poison-

ing caused by the Exhalation of Rhus radicans (Toxicodendron) at the Botanical Gardens, Hobart," 1886, p. 182; "Smut in Wheat," 1889, p. 95.

ANDERSON, WILLIAM (——1778.)

Died 3rd August, 1778, off the coast of Russian Asia, and an island sighted shortly after his death was named Anderson's Island. Cook says of him:—"He was a sensible young man, an agreeable companion, well skilled in his profession, and had acquired much knowledge in other sciences."

He was Surgeon of H.M.S. "Resolution," Cook's Third Voyage, and also acted as Naturalist. Quoted by Cook, e.g., in regard to Adventure Bay (Tasmania) plants in his "A Voyage to the Pacific Ocean," etc. 3rd Edition, 1795, pp. 106-8.

See R. Brown's "Prod. Florae Novae Hollandiae," p. 409, where his descriptions of plants in Cat. Banksian Library (Vol. 2, p. 52, and Vol. 3, p. 184) are referred to. In his MSS. he described various genera, e.g., "Collema" (Goodenia, Sm.), "Euphocarpus" (Correa, Sm.); "Ramsaia" (Bauera, Banks); "Aromadendrum" (Eucalyptus, L'Herit.).

He is commemorated in "Andersonia sprengeloides," R. Br.="Sprengelia Andersoni," F. v. M. Brown says his genus not only commemorates William Anderson, but also Alexander Anderson, of the Botanic Gardens, St. Vincent.

ARCHER, WILLIAM (1820-1874).

Born at Launceston, Tasmania, 16th May, 1820; died at Fairfield, near Longford, Tasmania, 14th October, 1874; was educated at a school at Longford, and afterwards went to England, where he qualified as an architect, and, returning, practised in Tasmania.

He was elected a member of the first Legislature of Tasmania in 1851, and on his return from a second sojourn in England in 1860, became a member of Mr. Weston's Ministry. He also twice represented Devon in the Assembly. On the death of his father he came

into possession of Cheshunt, Deloraine, named after the town in Hertfordshire, whence the Archers emigrated early in the last century. Cumming's Head is the mountain overlooking the Cheshunt Estate, and is often quoted in Archer's plant-labels.

In 1860 he succeeded Dr. Milligan as Secretary of the Royal Society of Tasmania, and held that office for two years.

"It remains only to mention my friend, William Archer, Esq., F.L.S., of Cheshunt, who, after a residence of upwards of ten years in Tasmania, during which he sedulously investigated the botany of the district surrounding his property, returned to England, 1857, with an excellent herbarium, copious notes, analyses, and drawings, and a fund of accurate information on the vegetation of his native island, which have been unreservedly placed at my disposal." **(2)**

And, again—

"I received the most encouraging assistance from my friend, William Archer, Esq., of Cheshunt, Tasmania, who forwarded to me a beautiful series of drawings of Tasmanian Orchids, together with £100 to be expended on the Flora, and he soon afterwards arrived in England, and rendered me still more valuable aid by his observations and collections, which is duly acknowledged in the body of this work . . . . adding 30 plates, including 60 species, chiefly of Orchideae (of many of which Mr. Archer had prepared the drawings)." **(2)**

Hooker dedicates his "Tasmanian Flora" conjointly to Gunn and Archer, which is excellent testimony to the value of the latter's services in the elucidation of Tasmanian plants.

His papers in this Journal include:—"Observations upon the Plants which are characteristic of Agricultural, Pasturable, and Bad Lands respectively in Tasmania," 1864, p. 96; "Notes on an Excursion to Cumming's Head and the Falls of the Meander, on the Western Mountains, Tasmania." "Ib.," 1870, p. 54; "Notes on the Californian Thistle," 1870, p. 70.

He is commemorated by the following plants:—Psoralea Archeri, F. v. M.; Mitrasacme Archeri, Hook. f.; Plantago Archeri, Hook. f.=?; Diselma Archeri, Hook. f.; Prasophyllum Archeri, Hook. f.; Carex Archeri, Boott.=C. acicularis, Boott.; Danthonia Archeri, Hook. f.=?; Dianella Archeri, Hook. f.=?.

I am much indebted for information furnished by his son. Mr. Walter K. Archer.

BACKHOUSE, JAMES (1794-1869).

An admirable observer, who botanised in most of the Australian colonies, 1838-41, and spent much time in Tasmania. He belonged to the Society of Friends, and was a philanthropist engaged on a religious mission. See (**5**).

BROWN, ROBERT (1773-1858).

The "Prince of Australian Botanists." I have dealt with him briefly at (**5**), and much fuller in my "Life of Sir Joseph Banks." He botanised much in Tasmania, and will for ever be identified with her flora.

CALEY, GEORGE (? 1775-1829).

He was in Tasmania in 1805, and in New South Wales, 1800-1810. He was a protege of Sir Joseph Banks. See (**5**), also my "Life of Sir Joseph Banks."

DAVIES, RICHARD H. ( ).

"The Rev. (sic) Richard H. Davies has discovered many curious and some new plants on the East Coast of Tasmania since the year 1833, which were communicated to Mr. Archer."

Richard Davies was brother of Archdeacon Davies. He contributed papers to the Royal Society, Tasmania, on the Natural History of the Mutton Birds, on the Aborigines of Van Diemen's Land, and the Rapacity of Tasmanian fish.

The following plant, Phebalium Daviesi, Hook. f.= P. glandulosum, Hook. var. (?) Daviesi was collected by R. H. Davies, Esq., Herb. Archer, on the East Coast, near St. Helen's Bay. See Hooker, "Fl. Tas.," ii., 358.

EWING, REV. T. J. ( ).

Of Hobart. He wrote papers on Statistics and Zoology (birds and insects) in the "Tasmanian Journal," Vols. i. and ii., and "Papers and Proceedings" of this Society, Vol. iii.

He gave attention to the native vegetation, and wrote on the large trees of Tasmania. He also collected Algae assiduously for Harvey, and Acanthococcus Ewingii, named by Harvey in his honour, was figured in the "Phycologia Australica."

FEREDAY, REV. JOHN (1813-1871).

Born 8th November, 1813, at the Ellowes, Staffordshire, England; died George Town, Tasmania, 8th April, 1871. He was Master of Arts and Fellow of Worcester College, Oxford.

"The Rev. Mr. Fereday, the Episcopalian Clergyman at George Town, Tasmania, an enthusiastic lover of natural history, especially of algae. He had a boat and dredge, and at once volunteered himself as a firm ally and assistant." ("Memoir of W. H. Harvey," p. 282, 1854.)

Harvey dedicated the 4th volume of his "Phycologia Australica" to Mr. Fereday in the following graceful terms:—

"To the Rev. John Fereday, M.A., of George Town, Tasmania, who has cultivated several branches of natural history, and to Mrs. Fereday, an accomplished and successful collector of algae, the fourth volume of the "Phycologia Australica" is inscribed in grateful memory of many kindnesses conferred on the author during his stay at George Town."

In the preface to Vol. 5, Harvey says:—

"During my residence at George Town, Tasmania, the Rev. J. Fereday rendered me the most efficient aid in prosecuting my researches. His boat and strong arm were almost daily at my service, and many thousands of specimens were collected under his auspices. He knew all the best localities on the Tamar, and was continually my guide to them. Without his able guidance and active assistance my visit to George Town would have proved comparatively unfruitful, instead of yielding me a rich harvest of specimens. To Mrs. Fereday I am indebted for many beautifully preserved specimens, and for aid in "laying out" and drying the tubsful of delicate algae which we almost daily brought home."

Samuel Hannaford (See p. 10), himself also a student of Algae, describes in his "Wild Flowers of Tasmania," pp. 75 and 85, a visit to Mr. Fereday, on which they botanised together.

Harvey figured the following plants in his "Phycologia Australica":—

Cladophora Feredayi, Harv.; Dasya Feredayæ, Harv.

I am indebted to Mr. Fereday's daughter, Mrs. Brewer, of Corowa, N.S.W., for some personal notes concerning her father.

GUNN, RONALD CAMPBELL (1808-1881).

Born at Cape Town, 4th April, 1808; arrived in Tasmania, 1829, died at Newstead, Launceston, Tasmania, 13th March, 1881.

As a child was at the capture of Mauritius and Bourbon with his father, whose regiment was afterwards at the Cape until the peace after Waterloo, when it was ordered to Barbadoes. R. C. Gunn was noted for a commission in the army, but eventually sailed for Tasmania in 1829. In 1830 he was appointed Superintendent of convicts for North Tasmania, in 1833 placed in the Commission of the Peace, and in 1836 was appointed Police Magistrate at Circular Head.

From Circular Head he made an expedition to the mainland, visiting Port Phillip, Western Port, and Port Fairy. In 1838 he was appointed Assistant Police Magistrate at Hobart Town, and in the following year Private Secretary to Sir John Franklin, and Clerk of the Executive and Legislative Councils. In 1841 he resigned these appointments to take charge of the estates of Mr. W. E. Lawrence, of Formosa, and subsequently spent most of his spare time in exploring the unsettled districts, and reporting on the flora of Tasmania. He represented the Northern districts in the Legislative Council and the House of Assembly, and was engaged by the Government in various exploratory expeditions for investigating the natural products and resources of the State.

In 1864 he was appointed one of the Commissioners for selecting the seat of Government in New Zealand.

"Ronald Campbell Gunn, Esq., F.R.S. and F.L.S., to whose labours the Flora of Tasmania is so largely indebted, was the friend and companion of the late Mr. Lawrence, from whom he imbibed his love of botany. Between 1832 and 1850 Mr. Gunn collected indefatigably over a great portion of Tasmania, but especially at Circular Head, Emu Bay, Rocky Cape, the Asbestos and Hampshire Hills, Western Mountains, Flinders and other islands in Bass' Strait, the East Coast, the whole valley of the Derwent, from its sources to Recherche, the lake districts of St. Clair, Echo, Arthur's Lakes, and the country

west of them to Macquarie Harbour, and the Franklin and Huon Rivers. There are few Tasmanian plants that Mr. Gunn has not seen alive, noted their habits in a living state, and collected large suites of specimens with singular tact and judgment. These have all been transmitted to England in perfect preservation, and are accompanied with notes that display remarkable powers of observation, and a facility for seizing important characters in the physiognomy of plants such as few experienced botanists possess. I had the pleasure of making Mr. Gunn's acquaintance at Hobarton in 1840, and am indebted to him for nearly all I know of the vegetation of the districts I then visited, for we either studied together in the field or in the library, or when he could not accompany me himself he directed one of his servants, who was an experienced guide—a plant-collector—to accompany me and take charge of my specimens. I can recall no happier weeks of my various wanderings over the globe than those spent with Mr. Gunn collecting in the Tasmanian mountains and forests, or studying our plants in his library, with the works of our predecessors, Labillardiere and Brown.

"Mr. Gunn made a short visit to Port Phillip and Wilson's Promontory, and collected largely, noting all the differences between the vegetation of the opposite shores of Bass' Straits." (**2**)

Hooker dedicated his Tasmanian flora conjointly to Gunn and Archer.

He was the most eminent botanist of Tasmania. His collections are widely diffused, and his neat handwriting, giving all the necessary details, is known to all Australian botanists who give attention to the history of Australian botany. I make no apology for giving details of his collecting grounds and other information concerning him. He corresponded regularly with Sir Joseph Hooker at Kew, and with Mueller, and all notable Australian botanists of his time.

"He corresponded with Sir William Hooker, sending plants to Kew, and with Dr. J. E. Gray, to whom he forwarded a series of mammals, birds, reptiles, and mollusca for the Natural History Museum. He helped to form the Royal Society of Tasmania. There is at Kew a coloured crayon drawing of him, artist uncertain. Bust, face three-quarters to the right; 14¼in. by 10½in." ("Kew Catalogue of Portraits of Botanists," 1906, p. 56.)

F.L.S., 1850; F.R.S., 1854; R.S.C. iii., 1887; "Journ. Bot.," 1881, 192; "Proc. Linn. Soc.," 1881-2, 63; Lasegue, 283; Hooker, "Flora Tasmania," cxxv.; "Proc. R. Soc.," xxxiv. (1883), xiii.; "Dict. Nat. Biog.," xxiii., 342 (**6**).

For a brief biography of him see (7). See also "Ann. Nat. Hist.," i., 101 (1838), also "The Botany of the Antarctic Voyage," [by J. Hooker (a review).=Richea pandanai folia] ("Tasm. Journal Sc.," iii.), Launceston, 1846. See also the list of his papers in the "Tas. Journ. and Proc. Roy. Soc. Tas." in Morton's Register, 1887.

Harvey dedicated the 5th Volume of his "Phycologia Australica" to him in the following terms:—

"To Ronald Campbell Gunn, Esq., F.R.S., F.L.S., of Launceston, Tasmania, who, with his accustomed liberality, placed at the author's disposal the whole of his rich collections of Tasmanian algae, this concluding volume of the 'Phycologia Australica' is gratefully and respectfully inscribed by his friend, W. H. Harvey."

In the Preface to Vol. 5, Harvey also says:—

"Ronald C. Gunn, Esq., F.R.S., whose name is indelibly associated with the botany of Tasmania, has largely assisted me in this work. From him came the earliest collections of Australian algae, which, through the kindness of Sir W. J. Hooker, fell under my notice. Many new species are of his discovery; to him is also due the re-discovery of Claudea elegans; and to him I am not only indebted for the freest use of his personal collections, but for multitudes of duplicate specimens;" and figured Nitophyllum Gunnianum, Harv., in his "Phycologia Australica."

He is commemorated by the genus Gunnia, and also by the following species:—

Boronia Gunnii, Hook.=Boronia pinuata, Sm. var. Gunnii; Cryptandra Gunnii, Hook. f.=Spyridium Gunnii, Benth.; Lasiopetalum Gunnii, Steetz.=L. dasyphyllum, Sieb.; Ranunculus Gunnianus, Hook.; Stackhousia Gunnianus, Schlecht.; and Stackhousia Gunnii, Hook., f., both=S. monogyna, Labill.; Tetratheca Gunnii, Hook. f.=T. pilosa, Labill. var. (?) procumbens; Acacia Gunnii, Benth.=A. vomeriformis, A. Cunn.; Desmodium Gunnii, Hook. f.=D. varians, Endl. var. Gunnii; Haloragis Gunnii, Hook. f.=H. teucriodes, A. Gray; Psoralea Gunnii, Hook. f.=P. adscendens, F. v. M.; Pultenaea Gunnii, Benth.; Rubus Gunnianus, Hook.; Aplopappus Gunnii, Hook. f.=Erigeron pappochroma, Labill. var. Gunnii; Asperula Gunnii, Hook. f.; Emphysopus Gunnii, Hook. f.=Lagenophora emphysopus, Hook. f.; Erechtites Gunnii, Hook. f.=E. quadridentata, D.C. var. Gunnii; Erigeron Gunnii, Hook. f.=E. pappochroma, Labill. var. Gunnii; Eucalyptus Gunnii, Hook. f.;

Eucalyptus Gunnii, Miq.=(?); Eucalyptus Gunnii, F. v. M.—E. Stuartiana, F. v. M. (as formerly understood); Eurybia Gunniana, D.C.=Olearia stellulata, D.C.; Helichrysum Gunnii, Hook. f.—H. scopioides, Labill.; Lagenophora Gunniana, Steetz=. Huegelii, Benth.; Melaleuca Gunniana, Schau.—M. ericifolia, Sm.; Ozothamnus Gunnii, Hook. f.=Helichrysum Gunnii, F. v. M.; Panax Gunnii, Hook. f.; Tetrapora Gunniana, Miq. =Baeckea Gunniana, Schau.; Decaspora Gunnii, Hook. f.=Trochocarpa Gunnii, Benth.; Epacris Gunnii, Hook. f.=E. microphylla, R. Br. var. Gunnii; Limanthemum Gunnii, Hook. f.=Liparophyllum Gunnii, Hook., f.; Richea Gunnii, Hook, f.; Veronica Gunnii, Benth.=V. calycina, R. Br.; Villarsia Gunnii, Hook. f.=Liparophyllum Gunnii, Hook. f.; Banksia Gunnii, Meissn.=B. marginata, Cav.; Muhlenbeckia Gunnii, Hook. f.=M. adpressa, Meissn. var. hastifolia, Meissn.; Persoonia Gunnii, Hook. f.; Plantago Gunnii, Hook. f.; Caladenia Gunnii, Reichb.=Chiloglottis Gunnii, Lindl.; Callitris Gunnii, Hook. f.=Frenela Gunnii, Endl.—F. australis, R. Br.; Casuarina Gunnii, Hook. f.—C. stricta, Ait.; Fagus Gunnii, Hook. f.; Phyllanthus Gunnii, Hook. f.; Pimelea Gunnii, Hook. f.=P. cinerea, R. Br.; Sarcochilus Gunnii, F. v. M.=S. parviflorus, Lindl.; Aphelia Gunnii, Hook. f.=A. gracilis, Sond.; Carex Gunniana, Boott.; Cladium Gunnii, Hook. f.; Cyperus Gunnii, Hook. f.; Danthonia Gunniana, Nees—D. racemosa, R. Br. var. pencillata; Echinopogon Gunnianus, Nees= Deyeuxia Gunniana, Benth.; Hymenophyllum Gunnii, Bosch.=H. rarum, Br.; Isoetes Gunnii, A. Br.=(?); Isolepis Gunnii, Steud.=Scirpus inundatus, Spreng.; Juncus Gunnii, Hook. f.=(?); Lepidosperma Gunnii Bœckel.=L. lineare, R. Br.; Microlæna Gunnii, Hook. f.=M. stipoides, R. Br.; Scirpus Gunnii, Bœckel.=S. cartilagineus, Spreng. var. alpina.

HANNAFORD, SAMUEL (1828-1874).

Victorian and Tasmanian botanist. Resident both of Launceston and Hobart. Born at Totnes, Devonshire; died at Hobart, 3rd January, 1874.

He emigrated to Melbourne in 1853; became at once an honorary coadjutor of Mueller in Victorian botany. He resided in Warrnambool in 1855 and 1856, then re-

moved to Geelong till 1863. For a time he edited the "Victorian Agricultural and Horticultural Gazette." He became editor of the "Launceston Times," and in 1868 removed to Hobart. In 1870 he was librarian of the Public Library there.

He industriously botanised for nearly the whole of his residence in Australia, sending largely to Mueller. Some of his specimens have fallen into my hands, and the labels show him to be most neat in his methods and scientifically accurate in his details. Mueller named the genus Hannafordia (Sterculiaceae) after him.

He co-operated with the Rev. John Fereday in collecting algae at the Tamar Heads, Tasmania, for Harvey, who in his "Phycologia Australica" figured Ptilota (?) Hannafordi, Harv.

He published four works—viz., "Flora Tottoniensis—Flowering plants and ferns . . . of Totnes" (Totnes, 1851); "Jottings in Australia, or Notes on the Flora and Fauna of Victoria" (1856); "Sea and Riverside Rambles" (1860); "The Wild Flowers of Tasmania, or Chatty Rambles Afloat and Ashore Amidst the Seaweeds, Ferns, and Flowering Plants, with a Complete List of Indigenous Ferns and Instructions for their Cultivation" (8vo., pp. 188, 1866).

The last three works were published in Melbourne. See also (**7**).

HARRAP, E. D. ( ).

There is a paper by him entitled "Observations on Desmidiaceae, with a List of Species found in Tasmania" (this Journ., 1868, p. 19). There is also a paper on Fluke, and another on Phyllactidum, in the 1869 volume. I know nothing further of this botanist.

HARVEY, WILLIAM HENRY (1811-1866).

The celebrated Algologist, who visited Tasmania in 1855. There are papers by him on the Algae of Tasmania in "Tasm. Journ. ii., 377, 421 (1846), and iii. 54, 153, 209 (1849).

I have dealt with his work at some length in (**5**).

JEANNERETT, Dr. ( ).

He is spoken of in 1849 as "late Superintendent of the Aborigines" (see Blue-book, "Papers relative to Crown Lands in the Australian Colonies," Part ii., 1851).

Resided at one time at Port Arthur. Harvey speaks of having received from him a number of interesting Algae and the genus Jeannarettia, Hook. fil., et Harv. was dedicated to him. See Harvey's "Nereis Australis."

Harvey also speaks of him as "an investigator of the botany of Tasmania," and figures in his "Phycologia Australica," Jeannerettia lobata, Hook. f., and Harv., and Ptilota Jeanerettii, Harv.

LABILLARDIERE, JACQUES JULIEN HOUTEN de (1755-1834).

He was botanist to the expedition in search of La Perouse in command of Captain d'Entrecasteaux, whose ships were the "Recherche" and "L'Esperance." He was in Tasmania in 1792, and many Tasmanian plants were figured in his "Novæ Hollandiæ plantarum specimen" (Paris, 1804-06).

It is my intention to publish a separate account of the French botanists who advanced Australian botany.

LAWRENCE, ROBERT WILLIAM (1807-1833).

Died at Formosa, Tasmania, on 18th October, 1833, aged 26 years (the anniversary of his birth).

"He led me (Gunn) to commence the study of botany." J. G. Robertson, who was manager of Formosa (see **8**) was doubtless influenced in his botanical studies by Lawrence.

"In 1826 Mr. Robert William Lawrence, a settler in Tasmania, commenced exploring the northern parts of that island and forming collections, which were communicated to Sir W. Hooker up till 1832, when he died. Some of these plants were published in the 'Companion to the Botanical Magazine,' 'Journal of Botany,' 'Icones Plantarum,' and elsewhere." (**2**).

See "Contributions Towards a Flora of Van Diemen's Land, from Collections sent by R. W. Lawrence, Ronald Gunn, and Thomas Scott, Esqs." ("Comp. Bot. Mag." i., 272.) I have also the reference to a paper by Lawrence "On the Flora of the Western Mountains of Van Diemen's Land" ("Bot. Miscellaneous," 2 vols., 1825-1844), but I have not been able to trace the work. See also (**6**).

He is commemorated by the following species:—

Correa Lawrenciana, Hook; Cryptandra Lawrencii, Hook, f.=Spryidium Lawrencii, Benth.; Sida Lawrencea, F. v. M.=Plagianthus spicatus, Benth.; Helichrysum Lawrencella, F. v. M.; Monemios Lawrencii, Hook. f.=Microseris Forsteri, Hook. f.; Pterygopappis Lawrencii, Hook. f; Scorzonera Lawrencii, Hook. f.=Microseris Forsteri, Hook. f.; Libertia Lawrencii, Hook. f.=L. pulchella, Spreng.; Podocarpus Lawrencii, Hook. f.=P. alpina, Br.; Orthotrichum Lawrencei, Mitt (a moss).

LHOTSKY, JOHN ( ).

Was for some time in Tasmania as a Government Medical Officer, and made botanical observations in that colony, and also in New South Wales. See (**2**).

MEREDITH, LOUISA ANN, Mrs. (nee Twamley), (1812-).

Born at Hampstead, near Birmingham, on 20th July, 1812.

On 18th April, 1839, married her cousin, Charles Meredith, and shortly afterwards came out with him to the Meredith home at "Cambria," near Swansea, Tasmania, now rich in historical associations.

The father of John Meredith, Esq., brother-in-law of the above of "Cambria," whose hospitality I enjoyed some years ago, was the first white man to land on the adjacent beach in 1821 or 1822.

She was the author of "My Home in Tasmania," with landscape illustrations by the Bishop of Tasmania (Dr. Nixon) and the author; "Some of My Bush

Friends in Tasmania" (1860), a large and elaborate work on the flora of the colony, with numerous coloured plates from the author's drawings. In 1891 was published a second series of "Bush Friends in Tasmania." She was a voluminous writer, and published many other works, which are enumerated in (**7**).

She did much to advance a knowledge of Tasmanian plants by contributing coloured drawings of them to many international exhibitions. She was made an honorary member of this Society.

MILLIGAN, JOSEPH (1807-1883).

Born in Dumfriesshire; M.R.C.S.E. 1829; was appointed surgeon to Van Diemen's Land Co.'s establishment at Surrey Hills in 1830.

Became Superintendent of the Aborigines, and visited their establishment at Flinders Island in 1843; remained in charge till 1855, superintending the removal of the aborigines from Flinders Island to Oyster Cove in 1848. He left Tasmania in 1860.

"Dr. Joseph Milligan, of Hobarton (now Secretary to the Royal Society of Hobarton), has, since the year 1834, visited many parts of Tasmania, and made several most interesting discoveries, especially on its loftiest mountains and East Coast." (**2**)

He was one of the founders of this Society, and its Secretary from 1844 to 1860. He was considerable authority on the aborigines of Tasmania. A list of his papers will be found at p. 24 of Morton's Register of Papers in the "Tas. Journ. and Roy. Soc."

His "Vocabulary of Dialects of the Aboriginal Tribes of Tasmania" is reprinted in Brough Smyth's "Aborigines of Victoria" ii., 415-433.

He wrote chiefly on the aborigines, meteorology, and zoology. He was employed by Governor Sir William Denison, in the interval of other duties, in making surveys and reports on some of the numerous coal-fields on the island. (See Blue-book, "Papers relative to Crown Lands in the Australian Colonies," p. 125, 1851.) There is a paper by him "On some Fossil Plants Found near Hobart Town and Launceston" ("Tas. Journ. iii., 131, 1849.) He was a most assiduous observer of Tasmanian plants, and collected largely.

He is commemorated by the following species:—

Eucryphia Milligani, Hook. f.=E. Billiardieri, Spach. var. Milligani; Helichrysum Milligani, Hook. f.; Cystanthe Milligani, Hook. f.=Pilitis Milligani, Hook. f.= Richea Milligani, F. v. M.; Dracophyllum Milligani, Hook. f.; Hakea Millagin, Meissn.=H. epiglottis, Labill.; Orites Milligani, Meissn.; Dendrobium Milligani, F. v. M.=D. striolatum, Reichb.; Pimelea Milligani, Meissn.

MUELLER, FERDINAND von (1825-1896).

Mueller contributed largely to the botany of Tasmania, but he was an Australian botanist, by no means confining his energies to one State. An account of his work will therefore be found in **(5)**.

NELSON, DAVID (——-1789).

Was a Kew gardener, and became Collector on Cook's Third Voyage (1776-80), H.M.S.S. "Resolution" and "Discovery."

Captain Clerke writes to Banks:—"Your man Nelson is one of the quietest fellows in nature; he seems very attentive, and, I hope, will answer your purpose very well. . . . He has made a trip up the country here with Gore."

H.M.S. "Discovery," Cape of Good Hope, 23rd November, 1776.*

From a letter at p. 406 it is evident that Banks paid Nelson's expenses.

Cook visited Adventure Bay, Southern Tasmania, in January, 1777, and a considerable collection of plants was made by Nelson and Mr. William Anderson, surgeon of the "Resolution;" these plants are now in the British Museum. He here collected twigs of a plant which were taken to Europe, and described by L'Heritier as Eucalyptus.

He was afterwards botanical collector in H.M.S. "Bounty," 1787, under Captain Bligh, when that ship

* Hist. Rec. of N.S.W., i. (I.), 405.

sailed for Tahiti to transport bread-fruit trees to the West Indies.

Bligh reported to Banks*, "Bounty," Spithead, 5th November, 1787:—

"The conduct of Nelson, the gardener, is very satisfactory."

He was one of those sent adrift by the Mutineers of the Bounty, and eventually died of the exposure†, and of fever at Coepang, Timor, 20th June, 1789. Bligh says of him—

"Whose good conduct in the course of the whole voyage and manly fortitude in our late disastrous circumstances deserves this tribute to his memory."

In dedicating the genus Nelsonia, of the Acanthaceae, to his memory, Robert Brown ("Prodromus") says:—

"Dixi in memoriam Davides Nelson, Hortulani meritissimi qui in ultimo itinere Cookii plurimas novas species plantarum primus legit, postea vero expeditioni priori Cel. Navarchi Bligh adjunctus, in insula Timor occubuit."

His Australian, Cape, and Timor plants are in the British Museum (6). See also "Gardeners' Chronicle," 1881, ii., 267.

NEWMAN, FRANCIS WILLIAM (? 1796-1859).

Died at the Botanical Gardens, Hobart, 23rd August, 1859, aged 63. He came from Sydney, and had been in charge since 1847. Buried at St. George's Cemetery (in the vault of Mr. H. Lipscombe, 27th August).

He was the immediate predecessor of Francis Abbott at the Botanical Gardens, Hobart.

OLDFIELD, AUGUSTUS FREDERICK (1820-1887).

Born in London 12th January, 1820; died in London 22nd May, 1887. His death was reported to this Society on 15th August following; see the Hobart "Mercury" of the next day.

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* Hist. Rec. of N.S.W., i. (2), 117.

† See also "Kew Bull.," 1891, 297.

His brother, Mr. E. D. Oldfield, kept a commercial school in Hobart for many years, and gave his brother's herbarium to Kew after his death.

He made extensive collections in Tasmania for Mueller and others (see "Fragmenta"), and a brief account of his researches in Western Australia will be found in (**9**).

"Mr. Augustus Frederick Oldfield, one of the early scientific investigators of Tasmania and Australia, died in London on May 22. He had been afflicted with blindness for nearly 20 years, consequent upon the fatigue, privations, and exposure incident to his wonderful feats of pedestrianism in the pursuit of his favourite study—botany. The new plant was to him a greater prize than the discovery of gold, and in his search for such he was most indefatigable, both in Tasmania and Australia; but some 20 years since his health became impaired and his sight affected. He went to London for treatment, but without avail, and he soon lost his sight altogether—a sad state, indeed, for one whose sole pleasures in life were dependent upon vision. However, though unable as an author to perpetuate the extensive knowledge he had acquired, he most unselfishly placed it at the disposal of those in a position to make it available in the world of science, as is testified to by Dr. Hooker, as President of the Royal Society, who, in supporting the claim of the now deceased to some substantial recognition of unrequited scientific labours, culminating in so sad an affliction as blindness, says:—'I have known Mr. Augustus Oldfield for nearly 20 years as a most active, able, industrious, and trustworthy naturalist, and especially botanist, whose disinterested labours and collections have thrown great lights on the flora of many distant, and some of them previously wholly unexplored, districts of Australia. I should add that the liberality with which he has dealt with the materials he collected is beyond all praise. He gave specimens and information of the most valuable description to public institutions, wherever they were likely to be of use, without return of any kind, and placed his knowledge at the disposal of naturalists in the most enlightened manner. To the Flora of Tasmania his labours were most important, and I am indebted to him for much valuable aid, as the supplement of that work especially shows. I can truly say that I know of no case of modest worth of heart, hand, and head more deserving of public recognition by the Governments of Australia than that of Mr. Augustus Oldfield.' The above testimony notwithstanding, as well as that of Baron von Mueller in a similar strain, failed to secure any such recognition as desired, though application for it was made to the Government of Tasmania. Some of the journeys performed by the deceased in his scientific investigations, alone and afoot, were not unattended with danger at a time when many aborigines were still in possession of their native home—the bush. However, by tact, he in some way placated them, and, although sometimes threatened, he was never in any way harmed. This was particularly the case when walking from Sydney to Mel-

bourne, some 40 years ago, and a few years subsequently from King George's Sound towards Adelaide, and again from Perth to North-Western Australia, where for a year or so he mixed freely with the natives, acquiring much knowledge of their language and habits, which formed the subject of a paper read before the Ethnological Society, London." (Melbourne "Argus," July 13, 1887.)

SCOTT, THOMAS ( ).

"Dr. Thomas Scott collected in Tasmania, and transmitted specimens to Sir W. Hooker about 1835" **(2)**

He was a collector of plants with Lawrence and Gunn. (See "Comp. Bot. Mag. i., 272.)

I have no further particulars concerning him, and no species seems to have been dedicated to him.

SHARLAND, WILLIAM STANLEY ( ).

Mr. Sharland was a Government Surveyor, and explored much of Western Tasmania in the early days. On the 8th March, 1832, he discovered Lake St. Clair, and subsequently examined the country as far as Frenchman's Cap. On returning from his survey tour he used to bring specimens of the flora for botanical friends, but did not himself collect. Mrs. Sharland made large collections of algae near the mouth of the Tamar.

She collected before Prof. Harvey's advent to these shores, for her collection of Tasmanian sea-weeds, sent to the International Exhibition of 1851, was awarded a bronze medal. The specimens were collected at Kelso, in the north.

" She was the daughter of Major Schaw, who served in the Peninsular War, and, after retiring from the Army was Police Magistrate at Richmond, Tasmania, for many years.

" She was, I believe, born at Jamaica, in the West Indies, 1813, and died at George Town, Tasmania, 1859."

The Rev. F. B. Sharland, son of the above, has kindly furnished most of the above particulars.

SMITH, CHARLOTTE, nee . . . . ( ).

Mrs. Charlotte Smith, of Circular Head, Tasmania, collected algae for Harvey, and Polyphacum Smithiae, Hook. fil., et Harv. was named in her honour.

Of MARY BALLANTYNE (MRS. SMITH) and JOHN GRANT SMITH, also early collectors of the Tasmanian flora, I can trace no particulars, nor of SMITH, McDONALD ( ), "Collector of Algae" (**2**).

SPICER, M.A., REV. W. W. (——-1879).

Formerly a member of Council of this Society, and in April, 1878 ("Proc. Roy. Soc. Tas.," 1878, p. 4), he was elected a Corresponding Member on the eve of his departure for England, a special resolution of the Council being conveyed to him.

He was the author of a meritorious "Handbook of the Plants of Tasmania" (Hobart, 1878) on the dichotomous system. He wrote both on botanical and economic entomology for the Proceedings of this Society. See papers on "Ergot" in the volume for 1877, p. 75, and on "Alien Plants," containing a list of Tasmanian aliens in the same volume, p. 62.

Mr. Spicer did a great deal of botanical work in England before he came to Tasmania, but it is not on record here. After his return to England he became Rector of Itchen Abbas, near Winchester, where he died about 1879.

Helichrysum Spiceri was named after him by Mueller.

STORY, GEORGE FORDYCE (1800-1887).

Born at Carlisle, England, 4th June, 1800. Died at Kelvedon, near Swansea, Tasmania, 7th June, 1887.

His father was a contemporary of John Wesley, and one of his itinerant preachers; he was a Doctor of Divinity, and in after years head of the printing establishment of the Wesleyans. G. F. Story was born when his father was 60 years old, and became a Friend, like his schoolfellow and old friend, Francis Cotton.

He was educated at the Marischal College, Aberdeen, and was apprenticed to Dr. George French in 1819 for three years, going through the medical course. He studied botany under Prof. Henderson. He obtained the degree of A.M. in 1820.

Going to Edinburgh in 1821, he continued his medical studies. Botany he studied under Prof. Graham. He attended at the Edinburgh Infirmary for one year (1824), and the degree of Doctor of Medicine was conferred on him the same year.

He was in private practice in London from 1825 to 1828.

Coming to Van Diemen's Land, he was appointed District Assistant Surgeon for the district of Great Swanport (Waterloo Point) in April, 1829. He was in charge of the Rocky Hills Probation Station, but practically lived at Kelvedon for the remainder of his life. Both Mr. Edwin Cotton and Mrs. Francis Abbott inform me that he was in charge of the Royal Society's Gardens, Hobart, before Mr. Newman's arrival in 1847. In 1843 the members of the Tasmanian and Horticultural Societies had determined to form a garden. The Botanical Gardens were originally part of Government House Gardens, surrendered by Sir John Franklin when the Tasmanian and Horticultural Societies combined to found the Royal Society.

He is buried on the property of Edward O. Cotton, of Kelvedon, Swansea, a relative, whose hospitality I enjoyed some years ago when I visited Swansea in my search for particulars of Dr. Story and to collect where Dr. Story collected, for he was an enthusiastic botanist. He collected largely for Mueller.

STUART, CHARLES (1802-1877).

Born in England; died at Parramatta, N.S.W., September, 1877, and was buried in the Church of England Cemetery there. This most meritorious botanist collected sea-weeds largely at Southport for Harvey (Phycologia Australica). Harvey figured Areschougia Stuartii, Harv., named in his honour. He states:—"Mr. Stuart's meritorious explorations of Australian

botany, both marine and terrestrial, worthily entitle him to the compliment gratefully bestowed on him in the specific name."

Stuart collected largely in New South Wales, and I have given an account of his botanical work in the record of the botanists of that State (**5**), to which I beg to refer my readers. That record includes a list of the Tasmanian plants named after him. He was a most accurate and careful observer, and his plants, most of which are in the National Herbarium, Melbourne, have labels which show him to have been a critical observer and an educated man with a very neat handwriting.

Through Miss Jessie Smith, of the Kurrajong, N.S.W., I have learnt the following additional particulars concerning Mr. Stuart:—Her father, the late Mr. Charles Heath Smith, met him in Tenterfield, N.S.W., in 1875, and employed him as a gardener at Guildford, N.S.W., until his death. He was a trained gardener, and well versed in astronomy as well as botany. He was employed by a Mr. Brown, in Tasmania, for part of his stay there.

I have seen a letter from Mueller to Mr. Heath Smith, dated 3rd August, 1877, in which he said that he met Mr. Stuart in Adelaide 30 years ago—that was immediately after Mueller's arrival in Australia.

RED OCHRE AND ITS USE BY THE ABORIGINES OF TASMANIA.
(PLATE IV.)

By Fritz Noetling, M.A., Ph.D., etc.

(Read May 3rd, 1909.)

There is hardly an account of the Aborigines of Tasmania in which the use of red ochre is not mentioned. Captain Cook, in the description of his third voyage, already states that the Aborigines smeared their hair and beard with a mixture of grease and red ochre. Later observers who came in contact with the Aborigines noticed the same. The old oil paintings in our Museum represent the male Aborigines as wearing a kind of red wig, composed of long corkscrew-like ringlets (1). We may therefore take it as granted that it was a favourite custom with the Aborigines to rub a mixture of grease and red ochre into the hair; and further, that this custom was strictly limited to the males. Nowhere is it mentioned that the females followed the same habit, though they frequently painted their face black with charcoal. The hair clotted with red ochre was strictly a male adornment, and it is very probable that the custom of the females wearing their hair closely cropped resulted from the desire to prevent them following the example of their masters.

When examining the camping grounds my attention was soon drawn to pieces of red iron ore lying about, and, after collecting a number, I noticed that several exhibited intensive signs of being used. The first specimens I found on the camping ground, Old Beach; others I found near Melton-Mowbray, Devonport, etc.; but the largest number and the largest piece I found near Baskerville and Winton, on the Macquarie River.

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(1) This is most conspicuous in the painting representing a group of Aborigines now in the Launceston Museum. All the males have the hair clotted with red ochre, while the females wear it closely cropped and in its natural colour.

Specimens of red ochre are by no means common. This is rather remarkable considering its frequent use. For instance, so far I have found only a single piece near Mona Vale, though to judge from the number of tronattas left this must have been a much-used camping-ground. Altogether I found 17 pieces, which cannot be considered a large number.

I have not been able to examine the specimens chemically, but the macroscopical examination is sufficient to prove that the red ochre must be a ferruginous substance. All specimens are strongly adhesive to the tongue; in other words, they absorb water readily, and are therefore hygroscopic. When broken they show an inner core of black colour, covered by a crust of intensely red colour. The thickness of the red crust varies, but so far I have not found any specimens in which it exceeds ¼ inch of thickness. These observations prove that the red ochre represents an iron ore, probably limonite ($2\ Fe_2O_3+3H_2O$), but also that the natural mineral has undergone a certain change, by which some of the water was removed. The dark brown natural colour of the limonite is superficially changed into a blood-red colour. The naturally non-hygroscopic limonite has been turned into a hygroscopic substance. The only way of producing such a change is by exposing the mineral to heat—in other words, by roasting it. That this view is correct is conclusively proved by the examinations of the specimens, all of which are more or less fire cracked.

We have therefore ascertained the important fact that the red ochre as used by the Aborigines is not a natural, but an artificial produce, being the result of roasting certain suitable iron ores in the fire.

The Aborigines had therefore already made an invention, which indicates a certain amount of logical reasoning. They discovered that when a certain heavy stone of dark colour is intensely heated, its surface changes into a red earthy substance. This invention may have been made accidentally, but it certainly shows a certain amount of observation, resulting in the subsequent extensive use of this red earthy substance instead of the material originally used for ornamental purposes.

Now, all the specimens show that the red oxide of iron resulting from roasting was subsequently removed, but not as we would suppose by either crushing the whole specimen or by grinding, but by scraping the roasted pieces. The red crust was scraped off by means of a tronatta, and the traces left behind by this operation are most chraracteristic. They consist in a number of parallel, short scratches, which might almost be compared to the scratches of ice-worn boulders. The appearance of the specimens, the curved scratched surface, sometimes exhibiting faces like a crystal, conclusively proves that the red crust cannot have been removed by grinding, but must have been taken off by scraping.

The question how the red ochre was removed from the roasted piece of iron ore is of some importance. It has generally been assumed that the so-called "mortiers" of Europe were nothing else but a kind of palette for grinding colours, in particular red ochre. Similar "mortiers" have been found in Tasmania, and I possess two typical specimens from Melton-Mowbray. The appearance of all the pieces of red ochre conclusively proves that the colour was removed by scraping, and not by grinding; the hypothesis that this peculiar kind of stones served as palettes is no longer tenable.

We may therefore assume that the Aborigines first roasted a suitable piece of iron ore, and afterwards scraped off the roasted crust, mixing the powder with grease, and then rubbed the whole mixture well into the hair, where it eventually dried, forming the peculiar ringlets which were the chief adornment of the "puggana" (1).

And what may be the origin of this peculiar custom? Strzelecki assumes that it was done to prevent the generation of vermin; but if this is correct, why did only the men and not the women resort to it? I think Ling Roth is quite justified in refuting this somewhat illogical theory, but he offers no other explanation. Perhaps the following hypothesis may be nearer the mark:—

The Tasmanian word for red ochre is ba-la-wine, which literally translated means "blood." The Tasmanian smeared "blood" on his hair, though this blood

(1) Adult Aborigine.

was no longer actual blood, but a powder resembling in colour to blood. We have here probably a kind of in colour to blood. We have here probably a kind of symbolical act, the last remains of a custom going the blood of the vanquished enemy on his own head. It would lead us away from the subject of this paper to discuss the various, sometimes uncanny, rites in which the blood of the vanquished enemy plays an important role. But if this view be correct, the primitive Tasmanian civilisation must already represent a type higher than that when actual blood was used instead of red ochre. Observations like this, which now and then lift the thick veil which covers the early history of the human race, make us shudder to think what miserable wretches those human beings must have been, compared to which the primitive Tasmanian represented a high state of civilisation.

The following words are given in the vocabularies of the Tasmanian language for "hair clotted with red ochre:—

(a) Ringlets (Corkscrews, with Red Ochre).

Eastern Tribes—Pow-ing-arooteleebana.
Southern Tribes—Pocena.
West and North-West Tribes—Poenghana.

(b) Hair (Matted with Ochre).

Eastern Tribes—Poinghana.
Southern Tribes—Poeena.

All these words are practically the same, particularly if we consider that the suffix, "arooteleebana," means nothing but the enhancement of the good qualities of the first word (1). We may therefore take it that

Poi-ngha-na or
Poi-na

means hair matted with red ochre.

Now we find under the heading Shave to (with flint), in Milligan's vocabulary, the following words:—
Eastern Tribes—Poyngha runn yale.
Southern Tribes—Poynghate rana yale.

(1) Without going into further details I cannot explain this, but in another paper I will give sufficient proof for this view.

The operation of shaving by means of a flint is here unquestionably expressed by two words, and it rather seems a puzzle to find an explanation for this. If we, however, write the second expression in the following way—

Poyngha-terana-yale,

this problem takes at once a different shape. Terana is undoubtedly the word teroona-trona-trowa, which we know stands for stone implement (flint).

The verbal translation is therefore

Poyngha—Hair, matted with red ochre.
Terana—Flint.
Yale—(?).

That is to say, the hair matted with red ochre (is removed by means of a) flint. It would be very simple if the still doubtful word "yale" would represent the verb, and simply mean "cut" or "removed," but this interpretation is more than doubtful, because yale occurs rather in a peculiar way in connection with other words, which make such a conjecture untenable. In conjunction with the words "noan," "loan,"—"stone," it must represent a particular kind of stone, and the question is, will we be able to fix on its meaning?

We know that the Northern and North-western tribes called the freestone ponin-galee; we have therefore

Loan-yale,
Ponin-galee,
Terana-yale,

and this seems to indicate that the "poingha" was shaved with a particular kind of flint, the "terana-yale," and if we were able to translate the word "yale," not only would we have explained the meaning of the words in question, but we would have ascertained a further most important point, namely, that the shaving the matted hair was done with a special kind of flint.

We find that under the heading freestone the following words occur:—

Eastern Tribes—Boatta or potha malleetye.
Southern Tribes—Potta mallya.
North and Western Tribes—Ponin galee.

I do not think that there can be the slightest doubt that the words used by the Eastern and Southern tribes are practically the same, and that freestone was called

Potta-malle(ea)—(mali).

In going through the vocabulary, we find under the heading "White,"

Eastern Tribes—Malleetye.
Southern Tribes—Mallee or Malluah.

North and Western Tribes—Mugyanghgarrah.

It is therefore unquestionable that

Potta malee(tye)

means a white or whitish rock. This fully agrees with the appearance of the freestone, which is a sandstone of light yellowish, frequently almost whitish, colour (1). There is not the slightest reason to assume that the "freestone" of the Western and North-Western tribes was different from that which occurs in the Southern and Eastern parts of the island. Though somewhat different in spelling, I have no doubt that

Ponin galee and potta malee

are exactly the same; in other words, that "galee" of the Western and North-Western tribes is the

Mallee(tye)

of the Eastern and Southern tribes, and means "white."

I do not think that there can be much doubt as to the identity of the words

Galee and yale(e),

and if this be so

"Terana yale"

would mean "white flint."

The complete verbal translations would therefore be—

Poyngha—Hair, matted with red ochre.
Terana—Flint.
Yale—White.

and the operation which Milligan freely translated as "to shave with a flint" would be expressed by the above three words.

(1) For instance, in the quarries near Austin's Ferry.

Now, it will at once be seen that, according to the position of the word "white," two quite different interpretations of the above words are possible.

If we assume that "yale" was the attribute of "terana," the translation would be—

(The) hair matted with red ochre (is cut with a) white flint,

and this would prove that the important, and probably also painful, operation of removing (cutting or shaving) the hair thickly clotted with red ochre was carried out by means of a special kind of flint—a white flint to whit.

Another interpretation is, however, possible if the word "yale" is not an attribute of "terana." We may then read it as follows:—

(The) hair matted with red ochre (with a) flint (was made) white.

Now, it is hardly surprising that in the Tasmanian language the same word is used to denote "white" and "clean." What is white is clean, and what is clean is white. The primitive Tasmanian language knew not the fine distinctions of our highly-developed one, and we may therefore read the above as follows:—

(The) hair matted with red ochre (with a) flint (was made) clean (1).

Though we succeeded in giving a literal translation of the words which Milligan presumed to mean "to shave with a flint," the true meaning of these words is by no means certain, and open to two widely different interpretations, and it has to be examined which is the more probable one.

At the end of his vocabulary Milligan gives a number of short sentences, which are of the utmost value. Among these we find—

He cuts his hair with flint—Tuggana pugheranymee trautta.

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(1) Of course we may also substitute the word "clean" for "white" in the first translation; but here the alteration does not produce such a change in the meaning. I suppose it mattered little whether the flint used was clean or dirty, though it would matter considerably whether it was "black" or "white."

Ling Roth has already remarked, and nobody can fail to note this, that Milligan's translations are somewhat free, and it is almost certain that this applies with some force to the above sentence.

Notwithstanding the different spelling, we recognise in the first word—

Tugga-na—

the Tasmanian word for a grown-up (adult) man, and the last word represents our well-known trowatta, the stone implement. We have therefore

Pagga-na—the adult man (black)

Pugheranymee—(?)

Trautta—flint.

Of course, the use of the impersonal, "the adult black man," instead of the personal pronoun, "he," signifies nothing. But what did he do with the trautta? If Milligan's translation were correct

"Pugheranymee"

must mean "to cut the hair," considering that we have accounted for the first and last word. This conjecture is, perhaps, rather hazardous. Whether clotted with red ochre or not, "hair" is represented by the words—

Eastern Tribes—Poing-lyenna,

Southern Tribes—Poiete-longwinne,

but it is impossible to recognise this word in the above. It rather seems as if "pugheranymee," if divested of the unnecessary suffix, is a kind of plural of the singular pugga-na. However that may be, it is certain that Milligan's translation cannot be correct. The adult black man does something with a flint, but he certainly does not cut his own hair (1). The second word rather seems to suggest that the "black man" does something with his flint for his brethren. Could it be accepted that this something was "hair cutting," the first view, namely, that "yale" was an attribute of "terana," and that a

(1) It may be remarked here that, if analysed, Milligan's sentence seems to be somewhat hazy. Is it probable that an Aborigine would have cut his own hair with his own hands with a flint? It is more than probable that somebody else performed the operation for him than he himself.

"white" flint was essential, seems untenable, because in this sentence a "trautta" plain and simple is used, and not a "terana yale."

There is another consideration: all authors agree that the Aborigines thought the hair clotted with ochre as a great ornament—in fact, that it was the usual, exclusive male adornment. According to Bonwick, a rebellion nearly burst out on Flinders Island, whence the remnant of the Tasmanians had been removed, when orders were once issued forbidding the use of ochre and grease. Now, is it possible that, considering the great value an Aborigine placed on his head ornament, that he would have voluntarily removed it by shaving? The women had the hair of their head closely cropped, but the men never followed this custom, at least there is no record that they ever did it. It is therefore very probable that Milligan's sentence, "He cuts his hair with a flint," is intrinsically wrong, because there is every probability that the pagga-na, the adult Aborigine, never did such a thing either to himself or to his friends.

It further follows that the translation "to shave with a flint" is also not quite correct, because the word "poingha" applies to hair clotted with red ochre, therefore to a male, and not to a female, whose hair was habitually cropped.

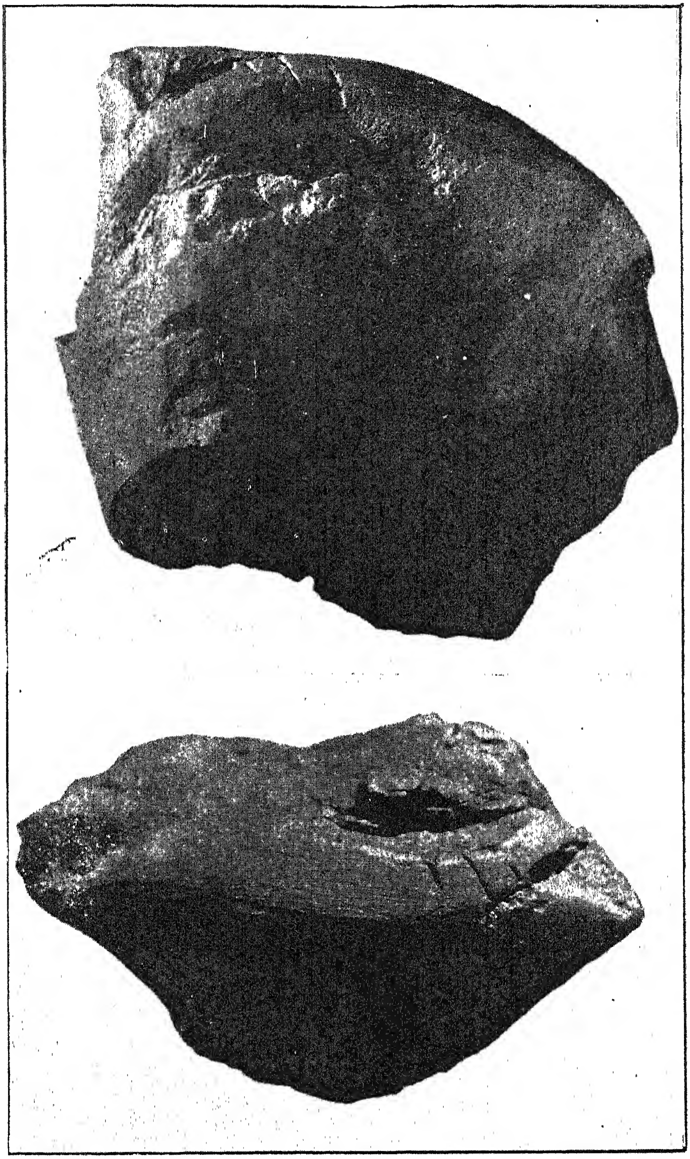
We must therefore assume that the words

Poyngha—hair, clotted with red ochre,

Terana—flint,

Yale—white,

really mean to clean (make white) the hair clotted with red ochre with a flint. No doubt that such an operation became necessary now and then, in order to give a fresh application of the valued mixture. There is equally no doubt that a good deal of the hair was involuntarily removed during this probably painful operation, and the Europeans who witnessed it thought this to be the object, and not the removal of the red ochre, and in want of a better word they described it as "shaving with a flint."



RED OCHRE FROM BASKERVILLE, MACQUARIE RIVER.

TASMANIAN ONAGRACEAE.
(PLATES V., VI.)

By L. Rodway, Government Botanist.

(Read 14th June, 1909.)

We have in Tasmania representatives of only two genera belonging to this family, Oenothera and Epilobium. Of the first genus we have only one species. It is a small herb of very restricted distribution, and was described by Sir J. D. Hooker in the Flora Tasmaniae. It was gathered by R. Gunn in marshy land about Marlborough in 1841, and does not appear to have been recorded since till the early part of this year, when it was found by G. Weindorfer and Dr. Sutton in the vicinity of Middlesex Plains. It is confined to the western portion of Tasmania, and neither it nor any other native member of the genus has yet been recorded from Australia or New Zealand. Bentham considered this species to be very close to, if not identical with, O. dentata, Cav., which is a native of Western America, extending from South Chili to California.

Our plant does not recall the idea of an Oenothera, as the calyx tube is just as short as it is in our Epilobiums, and would be readily taken for a small member of that genus, but the fruit and seeds are typical. In Hooker's description he gives the colour as purplish, but queries it. Bentham unhesitatingly states it as yellow. In Weindorfer's specimens they are all of a pale purple pink. The colour is very liable to be lost in herbarium material, and it is probable Bentham was misled from the prevailing colour of the genus. The anatomy appears to strictly conform to the type of the family. The cortex is relatively thick and soft, many of the cells being packed with acicular raphides. The phloem is not gathered in well defined bundles. The Xylem is copious in a continuous ring. There is a small pith with Intra-xylary phloem. The indumentum consists only of simple woolly hairs. The dentations of the leaves terminate in water-pores.

In the genus Epilobium we have six fairly well-marked forms, and they show an affinity with those of New Zealand. Four names other than those here adopted appear in standard works, namely, E. tetragonum, L.—A European plant that probably does not occur south of the equator. It was used to denote most of our larger forms before their distinctness from northern types was recognised. E. alpinum, L.—Some of our alpine forms appear identical with this, but it may be a coincidence, the two diverge materially in their common habitats. The typical form of E. glabellum, Forster, has not yet been gathered in Tasmania, though the name has been made much use in describing our forms. In the Flora Novae Zelandiae Hooker described a plant as E. tenuipes. He also grouped under the name two of our closely-allied plants, but the typical New Zealander does not appear to grow here. Our six species as here treated are:—

Ep. pallidiflorum, Sol.
Ep. Billardierianum, Ser.
Ep. junceum, Sol.
Ep. Gunnianum, Haussk.
Ep. confertifolium, Hook, f.
Ep. Tasmanicum, Haussk.

Our E. pallidiflorum conforms to the New Zealand type except that its flowers are pink, turning purple when dried, instead of white. E. Billardierianum is one of our commonest forms. It appears at nearly all altitudes, and varies somewhat, but it is the only form whose leaf is margined with numerous acute, irregular teeth. In the Flora Hooker figured our large flowered mountain plant as this, but even if he wished to include it he was in error figuring it as the type. E. junceum is our common form in lowland pastures and dry places, leaving the swamps to the last two. It has the same pale colour, due to woolly hairs, that marks the New Zealand plant. E. Gunnianum is the name given by Professor Haussknecht to the large floweret plant figured by Hooker. It is not a purely alpine species, and when it descends the flowers become reduced, but never as much so as in E. junceum, though it much resembles the latter in the leaves, which are bordered by few, remote, rather blunt serrations. E. confertifolium is essentially a plant of

sub-alpine moors. It trails for a few inches on the ground, has thick, narrow, oblong, overlapping leaves bordered by few teeth; its fruit is dark, glabrous, and dumentum on the stem and peduncle. It is one of the forms included by Hooker in E. tenuipes. The other is E. Tasmanicum, of Haussknecht. This is certainly rather close to the last, but the leaves are broad, entire on the margin or nearly so, and always stalked; the fruiting peduncle is very elongated, and the plant is quite glabrous. The appearance is very much that of the typical E. tenuipes, only that has very narrow leaves and smooth seeds. E. Tasmanicum occurs in New Zealand, but it is a rare species, and neither Kirk, Cheeseman, nor Haussknecht himself appear quite clear as to its characters.

All our species have broadly clavate stigmas and minutely papillose seeds. From descriptions of Epilobium, students would infer that the sepals are free or nearly so; in all our species the calyx is distinctly tubular at the base. Petals always notched in the centre. For the use of collectors I include a short analysis of the plants:—

Oenothera Tasmanica, Hook, f. Fl. Tas., a small, weak. vaguely-branched herb. decumbent or ascending not long stalked; it generally bears a fair amount of inamongst undergrowth, 2 to 4 inches high, slightly pubescent, with simple hairs. Leaves mostly opposite, narrow, oblong to ovate, of a thin texture, narrowed into a very short petiole, obtuse, about ½ inch long, bordered by a few small distant serrations. Flowers few, single in the axils, nearly sessile, about as long as the leaves. Calyx about 2 lines long, the lobes as long as the tube, the whole deciduous. Petals purple pink, rather exceeding the calyx obcordate, inserted at the orifice of the tube. Stamens eight, the four opposite the petals shorter than the sepaline ones, arising from the base but adherent to the top of the tube; anthers short, broadly oblong, minutely apiculate. Capsule about ½ inch long, lanceolate, obscurely tetraquetrous, nearly sessile, often slightly curved. Seeds minute, hairless, obovate, convex externally.

In wet sub-alpine places. Marlborough, Middlesex Plains.

In these Epilobiums the calyx has a short tube, the lobes are blunt to subacute indifferently, petals conspicuously notched, stigma broadly clavate, mature fertile seed papillose.

E. pallidiflorum, Soland., ex A. Gunn, Precurs. n. 550. Simple, erect from a shortly decumbent base, 1 to 2 feet, young parts delicately pubescent. Leaves opposite, sessile, lanceolate, narrowed or broad towards the base, 1 to 2 inches long, bordered by small, distant serrations. Flowers in many upper axils, exceeding the leaves. Sepals, ½ inch. Petals ¾ inch, pink, becoming purple when dry. Capsule 2 inches on a stalk rather shorter than the leaves.

Common in swamps.

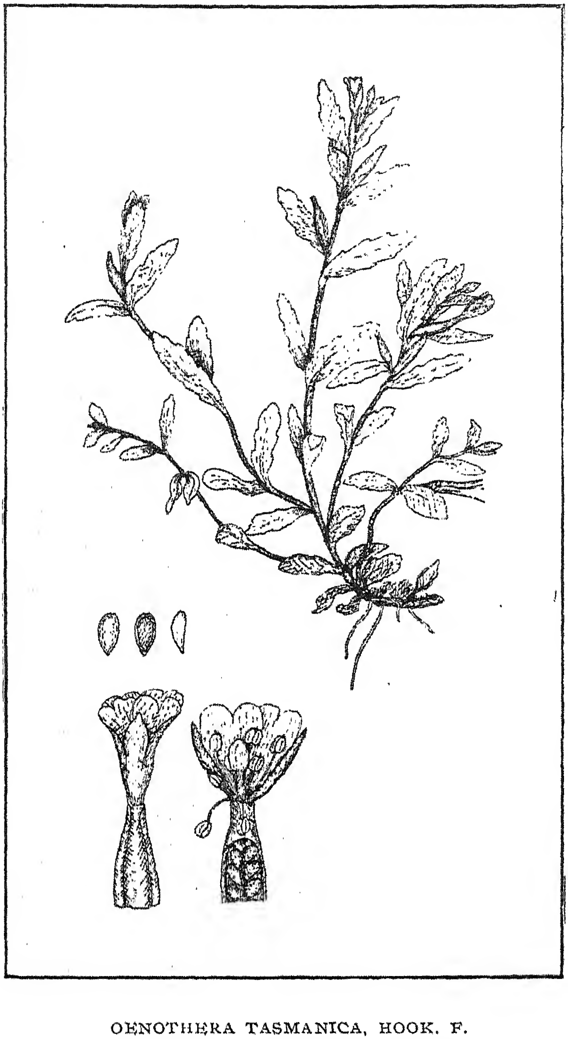
E. Billardierianum, Ser., in D. C. Prod., iii., 41. Decumbent at the base, emitting long, slender stolons with distant pairs of small ovate leaves, then erect, or flaccid in undergrowth, 1 to 2 feet high, delicately pubescent. Leaves ¾ to 2 inches long opposite, ovate, pubescent on the ribs, subacute, sessile, with an almost cordate base, margin with numerous small, unequal, acute teeth. Flowers in many of the upper axils similar to those of E. junceum, but larger. Capsules 2½ inches long, pubescent, on stalks shorter than the leaves.

Common in damp situations at all altitudes except mountain tops.

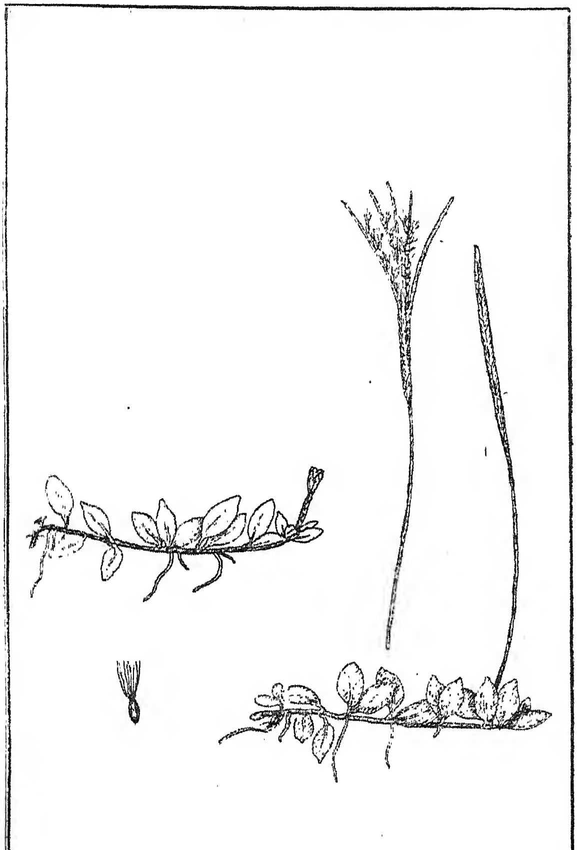
E. junceum, Soland., in G. Forst., Prod. n. 516. Erect or sub-decumbent, much branched towards the base, about 1 foot high, most parts clothed with a delicate white pubescence. Leaves mostly alternate, ½ to ¾ inch, narrow lanceolate, tapering at the base, bordered by a few distant, bold serrations. Flowers in many axils, exceeding the leaves. Calyx, 1 to 2 lines long. Petals slightly exceeding the sepals; light purple to nearly white. Capsule 2 to 3 inches; slender, on a stalk about one inch long.

Very common in lowlands in dry as well as damp situations.

E. Gunnianum, Haussk., Mono. Epilob. Erect from a decumbent base, ½ to 1 foot; stems and capsules minutely pubescent. Leaves mostly opposite, sometimes three together; narrow oblong, sessile or shortly stalked



OENOTHERA TASMANICA, HOOK. F.



EPILOBIUM TASMANICUM, HAUSSK.

usually, but not always rather thick, obtuse; ½ to 1 inch long, generally glabrous, bordered by distant serrations, which are usually small, sometimes bolder, at others obsolete. Flowers in the upper axils, few, exceeding the leaves. Calyx 2 to 4 lines. Petals, 4 to 6 lines, purplish to white. Capsule, 1 to 2 inches on a relatively short stalk.

Common, but principally at a high altitude.

E. confertifolium, Hook., f. Fl. Antarc. i. 10. Prostrate or ascending at the tip; 1 to 4 inches long; slightly, generally bifariously, pubescent. Leaves narrow, oblong, mostly opposite and secund; glabrous, shining, thick; ½ to 1 inch long; upper ones sessile or shortly stalked; the petioles of the lower ones often ½ inch long, margined with few distant serrations. Flowers few, exceeding the leaves on a short pubescent stalk, the ovary dark, glabrous. Calyx, 1 to 2 lines. Petals not much exceeding the sepals; pink, rarely white. Capsule, 1 to 1½ inches long, the stalk seldom as long as the leaves.

Common on mountain plateaux.

E. Tasmanicum, Haussk., Mono. Epilob. Prostrate, rooting at the nodes, all parts glabrous. Leaves broadly ovate, obtuse, opposite, stalked; ¼ to ½ inch long, shining; margin entire or with obsolete serrations. Flower usually solitary, exceeding the leaves, shortly stalked. Calyx, 1½ lines long. Petals about as long as the sepals, usually white. Capsule about 1 inch long, on a slender stalk, often exceeding 2 inches. Seeds papillose.

Franklin River, Picton River, Mount Humboldt.

THE SPEECH OF THE TASMANIAN ABORIGINES.

By Hermann B. Ritz, M.A.

(Read 14th June, 1909.)

I.—INTRODUCTORY REMARKS.

The reconstruction of the speech of the extinct Tasmanian Aborigines seems at first almost impossible, owing to the paucity and dubiousness of the records we possess; but after careful research we find that, though the records are scanty, yet they are fairly ample, considering the comparatively small number of the constituent parts of the language, and a reasonable degree of probability can be attained by a patient study of the material available.

As we proceed in our investigation, we find that the subject opens up most interesting avenues of thought, and promises to lead to important results in the domains of philology, ethnology, and anthropology. To exhaust it would require the labour of years; but it is possible and expedient to formulate a working theory and submit it to competent criticism, and this is what I now venture to do.

Before entering upon this working theory, it will be advisable to define the scope of the present investigation.

As a trained philologist, I am well aware of the classification of the languages of mankind, and have a working knowledge of a certain number of them; but I find the characteristics of the Tasmanian speech so primitive and unstable, that I cannot see my way to enrol it in any of the classes given by the text-books.

It might be called a root-isolating language, akin to the Chinese, but for the fact that its roots are liable to variation, within certain limits, not merely in the speech of different tribes or families, but even in the usage of

any individual speaker. Moreover, a root may have a certain meaning in one family and apparently a quite different meaning in the other, and phonetic changes seem to have been subject to accident rather than to phonetic laws. Of course, we are not bound to admit the existence of accidents, and we may reasonably assume that a law may be found, if we only will or can go deep enough to find it.

To find the law underlying the phenomena of the Tasmanian speech is the object of the present investigation.

Again, it has been suggested that this speech is akin to that of the Australian Continent or some parts of it, or to that of the South Sea Islands, or to that of the Andaman Islands, and on these assumptions, theories of ethnological affinity have been based.

Now, a scientific opinion on this must be founded on the knowledge of all the speeches in question, and is not within the scope of our present study, not only from want of sufficient knowledge, but also because of its extent and practical uncertainty. The similarity of speech between two distant races or tribes does not justify even a presumption of ethnological affinity, except in so far as we may assume the essential uniformity of psychological and physiological processes in all human beings. Still, on the latter assumption we may establish analogies, provided we can find the speakers of the different languages to be at the same stage of mental development.

Finally, the anthropological aspect of our subject claims our attention, because the evidence of the available records of the Tasmanian speech seems to show that those that used it represented the primitive, or at least very early, stage of human thought and speech. Moreover, it shows that however primitive their thought and speech were, they were of the same kind as those of all other races of which we have any knowledge.

It seems clear, then, that we must restrict our present researches to the Tasmanian speech; and even here we find a larger field than at first we should expect, and are therefore compelled to subdivide it, in order to formulate a reasonably complete statement of each part.

Practically all the available material is contained in H. Ling Roth's work, "The Aborigines of Tasmania" (Halifax, 1899), supplemented by H. De Charency's "Recherches sur les Dialectes Tasmaniens" (Alençon, 1880). A comparison of H. Ling Roth's work with the sources of his information proves that his work may safely be taken as a reliable standard of reference, as far as the main facts are concerned; the misprints and errors of transcription are comparatively few in number and easily corrected. We shall therefore be able to quote chiefly from that book.

De Charency simply gives a list of words taken chiefly from French authors.

Latham (1) and Müller (2) have dealt with the Tasmanian speech, but I purposely postpone the study of their theories until I have completed the elaboration of my own. I am familiar with the usual views on the subject of their works, and, on the other hand, do not wish to run the risk of unconscious bias in favour of any particular view until I have thoroughly investigated the original sources of information.

Taking, then, H. Ling Roth's book as our guide, we find that there are certainly several dialects of the Tasmanian language, and that these dialects are assignable to fairly definite geographical regions. The number of these dialects is difficult to ascertain; but on broad lines we can easily distinguish two, spoken in regions which are separated by mountains and other obstacles, viz., the Western and North-Western speech on the one hand, and the Eastern and Southern on the other. The records of the former are much scantier than those of the latter, and of these, more material is definitely assigned to the East Coast than to the region of the River Derwent.

We shall therefore begin our scrutiny with the records of the Eastern speech, then take those of the Southern, and finally those of the Western and North-Western dialects.

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(1) G. R. Latham, Elements of Comparative Philology, (London, 1862).

(2) Fried. Müller, Grundriss der Sprachwissenschaft (Vienna, 1876).

First, however, we must briefly refer to the characteristics of the records themselves. It is evident that the original writers of these records had no special training for this work. Many of them were men of considerable scientific attainments, but there was no specialist in philology among them, and even if there had been, the science of Phonology, indeed that of Comparative Philology itself, had not in their time emerged from mere empiricism to the rudiments of strictly logical treatment.

Again, some of the recorders were French, one was a Scandinavian, others were natives of different parts of the United Kingdom, and each of these recorded what he thought he heard and according to the way he tried to imitate the Tasmanian words. When we add to these causes of uncertainty the circumstances that orthography was not always a point of excellence in those days, we realise some of the difficulties attending our examination of the records. Still, some of these difficulties are not as great as one would expect. After all, the spelling was to a certain extent phonetic, and by pronouncing the Tasmanian words as if they were English, and comparing them with similar words of kindred meaning, we soon learn to fix the actual sounds with some certainty.

There is yet another difficulty with those records. When vocabularies and lists of phrases were beginning to be compiled, the influence of the white invaders of Tasmania had been active for about thirty years, and had almost completely destroyed the original conditions of the life of the Aborigines. The survivors had been collected, and their various dialects had been mutilated, and amalgamated into a sort of "lingua franca" made up of convenient native words and colloquial and technical English terms. Still, it is possible to pick out words characteristic of certain dialects, just as we could determine the Attic, Ionic, Doric, and Aeolian forms from a piece of Greek composition done by an ambitious schoolboy. Nor is the admixture of English words of serious consequence; the words are chiefly the names of things unconnected with the life of the Aborigines, and, fortunately for our purpose, the native syntax was not interfered with to any noticeable extent, owing to a very interesting circumstance. For it is peculiar to

English-speaking travellers that they endeavour to impress their meaning on the "foreign" natives by speaking very loudly and distinctly, and by using what has been called "jingalese" syntax, after the style of Mr. Alfred Jingle, which consists in uttering a series of names of things and actions without any attempt at connecting them.

Now, this is precisely the style of the Aboriginal speech, and the similarity of the two styles on the one hand confirms the conjecture that the Aboriginal style was a primitive, infantile method of conveying thought, and, on the other hand, it helps to explain the fact that English in its "pidgin" or "business" form is so easily acquired by foreigners.

In my interpretation of the Popela Song (Papers of the Royal Society of Tasmania, 1908), I had occasion to give some examples of this style of speaking, and we shall consider some further illustrations in due course.

For the present, we shall discuss only one point more, namely, the intonation of the Aboriginal speech, as regards word accent and phrase modulation. The records do not always indicate the word-accent, and when they do, they often vary. Two methods of indicating the accented syllable are used, viz., that of doubling the consonant after the accented vowel, and that of putting a small horizontal stroke over that vowel; and these methods are employed with sufficient frequency to allow of definite conclusions on the matter.

As an interesting illustration we may take the word for "bullock" or "beef," quoted by H. Ling Roth from Jorgensen's vocabulary (p. 182). Jorgensen says, inter alia, that buckelow or bacala, "bullock," is from the English, probably because there were no native bullocks. The English word "bullock" would be changed by metathesis into "buckle," and lengthened by the usual epithetic vowel into "buckla," or something like it. It is evident that the word accent rests on the first syllable. But Norman in his vocabulary (L.R., p. 1) gives the word as parkâllar. Now, in this vocabulary, we must eliminate the majority of the r's, as merely phonetic devices; thus we get pak lla, where the accent is not only marked by the stroke above the second a, but also by the doubling of the l following it.

Now, the Tasmanian word-accent was quite frequently on the third syllable from the end—the antepenult, so that the change in the present case cannot be due to a linguistic habit of placing the accent on the penult. There are at least two obvious explanations of this matter. The unstable character of the Aboriginal speech may have extended the word-accent, and left each speaker or family of speakers free to accentuate a word at random or at will. Indeed, we find strong evidence of such a state of things. For instance, H. Ling Roth quotes for "foot" or "leg" the following words —languna (p. ii.), lagarra (p. xi.), langna (p. xiii.), which seems identical with langana (p. xi.) with the accent on the first syllable, luggana (p. xxvi.), leunia (p. xxx.), langeneh (p. l.).

Again, the word buckelow may not be of English origin at all. This seems the more plausible view, for we find cognate words in the undoubtedly Aboriginal vocabulary, e.g., wakella—mussel (p. iv.), wakellina—sun or moon (p. v.), wakella—calf of leg (p. i.), all of which denote something "round."

The modulation of the voice in speaking is of the same kind as that found in European languages, for instance in English as spoken by a North Briton, a Welshman, or an Irishman. We find it most clearly expressed in song and in the love of singing, and the Tasmanian Aborigines afford good examples of it. H. Ling Roth (pp. 134 ff.) gives a good account of the music of the Aborigines; but a better idea of it can be gathered from hearing the songs themselves. This is possible to us, owing to that wonderful device called the gramophone. Mr. Horace Watson, of Sandy Bay, an ardent and sympathetic student of Aboriginal life, had shown much kindness to Mrs. Fanny Cochrane Smith, one of the descendants of the Aboriginal Tasmanians, and, on one occasion she was delighted to please him by singing two native songs into a phonograph. The circumstances thus render the sincerity of her performance unquestionable. The records are in perfect order, and Mr. Watson, to help me in my study of the Tasmanian speech, most generously gave me a copy of each. I hope to have an opportunity to translate and explain these records to the Royal Society; for the present I would only point out that the first song is

distinguished for the precision of its rhythm, and the second is perhaps an imitation, not of a Highland bagpipe, as Bonwick opined, but of the melody of a native magpie, which most unmelodiously the zoologists call a "piping crow."

II.—PHONOLOGY AND SEMASIOLOGY.

H. Ling Roth, in his "Aborigines of Tasmania," tabulates some 3,000 words of their language. As I have stated before, his lists are fairly accurate copies of the original sources of his information, and may safely be used as a basis for our detailed investigation. We shall take our examples chiefly from the Appendix. The original recorders endeavoured to write phonetically. Thus we find on the one hand a considerable variety in the spelling of the same Aboriginal words, and, on the other hand, this variety itself enables us to fix the actual sound, because there is in most cases only one group of sounds than can be phonetically represented by all the varieties of the spelling.

But here we meet with a phenomenon which seems to present an insuperable obstacle, and yet contains the key to a plausible solution of the whole question; for we find in words of the same dialect such similarity as argues an identity of meaning, and such differences as are in other languages found as distinguishing characteristics of different dialects. We may assume words to be of the same dialect, if they appear in the vocabulary of a recorder who did not meet with more than one tribe of Aborigines, or who had sufficient knowledge of different tribes to be able to assign each word to its proper origin. Among the former are chiefly the navigators, e.g., Cook, Péron, and La Billardière; among the latter we may mention Norman, Jorgensen, and Milligan.

Now, these quasi-identical words might have come from different tribes, and thus have formed a composite vocabulary, especially as we find, on comparing the various dialects, that they evidently are species of the same generic language. But we read in H. Ling Roth's

work (p. 166) that Mr. Robert Clark, catechist, states that on his arrival at the Flinders Settlement, in 1834, eight or ten different languages or dialects were spoken among the 200 natives then at the establishment, and that the blacks were instructing each other to speak their respective tongues. This would not have been necessary if there had been a common vocabulary, such as we find in the various dialects of English, French, German, etc.

Again, Milligan wrote (L. Roth, p. 180):—"The circumstance of the Aboriginal inhabitants of Van Diemen's Land being divided into many tribes and sub-tribes, in a state of perpetual antagonism and open hostility to each other, materially added to the number of the elements and agents of mutation ordinarily operating on the language of an unlettered people. To this was superadded the effect of certain superstitious customs everywhere prevalent, which led from time to time to the absolute rejection and disuse of words previously employed to express objects familiar and indispensable to all, thus tending arbitrarily to diversify the dialects of several tribes. The habit of gesticulation and the use of signs to eke out the meaning of monosyllabic expressions, and to give force, precision, and character to vocal sounds, exerted a further modifying effect, producing, as it did, carelessness and laxity of articulation and in the application and pronunciation of words. The last-named irregularity, namely, the distinctly different pronunciation of a word by the same person on different occasions, to convey the same idea, is very perplexing until the radical or essential part of the word, apart from prefixes and suffixes, is caught hold of."

Dr. Milligan's opinion is of great weight, as he made special efforts to obtain reliable information, and had special facilities for investigation. It is his last-quoted sentence that indicates the starting point of our present researches.

When we examine the syllables of the Aboriginal words, we notice that they are few in number and simple in structure. This is due to the paucity of consonants and vowels, and even these may be reduced, owing to the peculiarity that they can be arranged in groups, the members of which are interchangeable.

H. Ling Roth (p. 183) enumerates the following consonants—"b, c (? k), g, h (only at the end of words), k, l, m, n, p, q (qu) [? k], r, t, [w], ch, and gh (pronounced as in German hochachten)."

Now, it will be shown that, very probably, these may be reduced to the following groups—b p w, d t, g k ch gh, l m n r ng.

d is apparently characteristic of the Western dialect; H. Ling Roth does not include it in his list; ng, belonging to most dialects, is also omitted.

Again, we find l, m, n, r, ng as alternatives of t, p, t, k respectively; ng may also stand for n, sometimes for nag. Thus we have practically only four consonants, corresponding to the labial, dental, guttural, and liquid sounds; the liquid sounds themselves are often assignable to other groups.

The vowels, again, are liable to be changed at will, within certain limits. For instance, we have the same meaning expressed by pana, pena, piena, poina, puna; (v. infra).

It should be stated that in this essay the vowels of Tasmanian words are to be read as if they were Italian. This is probably not quite accurate, but sufficiently so for our purpose, especially in view of the instability of the Aboriginal speech-sounds.

Thus the number of possible syllables was very small; but we shall see that, though small, it was sufficient for the needs of the speakers. The long words of our vocabularies can be cut up into syllables which are the real words of the language.

In my essay on the Evolution of Words, part of which I read before this Society in September, 1905, I endeavoured to connect the original speech sounds with definite psychic states and processes, and the principles then enunciated seem to be strikingly illustrated in the clearly primitive speech of Tasmania. I shall have occasion to refer to them incidentally later on; for the present, one example will suffice. On page 17, I wrote, inter alia—"Terms of endearment are essentially of an objective character, and require sounds of high pitch.

The thin, bright sounds, t, l, i, n, s, are typical of diminutives, not only in nouns, but also in adjectives, and even in verbs." Now, in Tasmania, we find ina, enna, itia as suffixes indicating diminutives, analogous with the German ing, the English kin, the French il, in, et, the Italian illo, ino, etto.

The Tasmanian diphthongs may be divided into two groups. H. Ling Roth gives au, oi, and ou, but omits ie, ia, as he takes the i of the latter group to be a consonantal i. The group au, oi, ou, to which we may add oa, simply represent an unstable a or o, whereas ia, ie, ea, are developments of i or e, indicating a lengthening in time or space, as expressed by delay, interval, or a curve; wina is a straight stick, wiena a bent or broken one.

Of the consonants, the liquids alone are capable of continuance; they therefore fitly represent motion. We find, accordingly, that lia (also in the forms of lena, liena, lila) means missile, leg, water, bush fire, iguana, kangaroo, cat, gun, crow, movable shelter, nest, stone (missile or cutting tool); ria (also rene, riawe, riena, rina) means toe, hand, finger, to polish, water, dance, kangaroo, rat, to run; ni, (also nina, nile, none, noana, nuna, nuena), means you (i.e., away from me), no, hand, take away, fire, flea, stone implement; mina (also mena, manga, mana, meuna), means I, mine (i.e., towards me), lips, beak, sick (restless), tongue, bird.

The labial consonants represent a sudden puff, a sending forth of energy, and are therefore very appropriate for expressing action and purpose. Thus we find pa (also ba, wa, ma) as the general suffix of verbs; as suffix, prefix, or infix, it expresses power, emphasis, magnitude. Mana, mena, mina, meaning "I," may well indicate, besides "motion towards me," the prime importance men attribute to their own persons. It is interesting to note that most European languages use me or mi as the pronoun of the first person. We find, further, that pena (also pana, penina, pina, poine, puna) means lance, oar, laugh, fish, pointed, sharp, bird.

The dental consonants, pronounced by practically shutting the teeth, indicate inclusion and exclusion, and by their sound, a sudden stop or thud. Here, again,

nina, nara, besides meaning "motion away from me," may indicate the non-ego, the outer world, i.e., you, he, she, they, that thing; ni or noi, similarly, may mean negation, as well as "apart from." Tana (also tawe, tia, tiena, tienbug, tona, toni), means was (at a distant time), depart, heap, mound, to add, vanish, sink, spark, call (to a distance). Na, as "that thing," is the general suffix for nouns and adjectives, sometimes replaced by ra or lia.

The guttural consonants may express disgust (as in the sound of retching), or something connected with the dropping of the chin. For the former meaning we have the common suffix ak or ik, expressing dislike, unpleasantness, also negation. For the latter we have kana (also kami, kaiena, kuna), meaning mouth, teeth, jaw, cheek, to speak, to sing, to reject.

It will be observed that in the examples given, only the first consonant, with the following vowel or diphthong, enters into the argument.

The sounds r and l have other functions besides that of indicating motion; they also denote emphasis, especially the r. Of course, a moving thing has more energy than a stationary one. In Norman's vocabulary, the letter r is very conspicuous; in most instances it is merely a phonetic device to assure a correct pronunciation, but in others it probably indicates the throaty bass-voices of the Aboriginal speakers.

This is practically the whole material of the speech of the Tasmanian Aborigines. All things were distinguished according to two ideas, namely, rest and motion. The liquid consonants expressed motion, and all the others, rest. This is the explanation of the frequent interchange of sounds within two groups. By a development of psychic activity, it came to pass that the dental sounds signified rest simply, the labials, rest attained after motion, the gutturals, motion after rest, and the liquids, simple motion. From these four groups, practically represented by four simple syllables, the whole speech was formed, as will appear plausible from our further demonstration.

There were so few things of interest to the Aborigines, that they could easily express them by a small

number of words. Of course, any particular thing could not be denoted by their words except by the aid of gestures and convention, as in the names of persons and places. And this explains why the dialects were apparently foreign to each other. What would in one tribe be named after its speed, would in another take its name from its habit or size. Indeed, I am inclined to hold, against the current theory that the Tasmanians had no generic names, that they had no specific words, even the proper nouns being made up of generic constituents.

In the examples given so far, we observed chiefly the first consonant, with the following vowel which made it audible, and took no heed of anything that came after these.

The vowels were, as has already been pointed out, so unstable as to be of no importance for our demonstration.

We will now proceed a step further, by adding another consonant to the syllable, with or without another vowel, as may be found convenient.

From the four primitive words we derive twelve secondary terms, three from each. It is evident, from what has been shown, that if the second consonant is of the same class as the first, the result is merely a strengthening of the first, by repetition. For instance, lala, ant, is the swift runner; lane, to strike, flog, look, is repeated or forcible motion towards some object; mamana, tongue, is the repeatedly moving pointed member; nala, manana, earth, the movable part of the surface of the ground; nama, white man, the rover who has no tribe to stay with; nami, a stone than can be rolled or carried or thrown; ralla, frog, the swimming and hopping thing, also energetic, full of movement; rene, run; rilia, fingers, movable limbs.

The first syllables uttered by an infant are naturally pa, ba, ma, and later, na, etc. Hence we have in most languages words like baby, mama, papa, nana. In Tasmanian, too, we have pawe, pawawe, little child; nina mina, (my) mother, father.

We must be careful to avoid mistaking the n of the nominal suffix na for the final consonant of the previous syllable, or vice versa.

We shall have therefore the following twelve combinations—liquid+labial, liquid+dental, liquid+guttural, labial+dental, labial+guttural, labial+liquid, dental+guttural, dental+liquid, dental+labial, guttural+liquid, guttural+labial, guttural+dental. These may be illustrated as follows:—

(1) Liquid+labial—motion+purpose: lapa, wing; lapri, see, leipa, lopa, fire; lepena, eye; lepina, lepera, neck; lewana, wind; lube, sheoak tree (the best firewood); lupari, free.

Mapa, black, the darkness moving over the sky and earth, (we have also lewara, night); mebia, moving away.

Newina, eat; newitie, kangaroo; niparana, face; nubra, nupre, eye; nubena, crayfish (motion and purpose are shown in the claws).

Rabalga, hand (the member which takes); roba, to rush; ruwa, sand-lark; roba and ruwa are perhaps simply ro+pa, i.e., moving quickly or energetically.

(2) Liquid+dental—motion+rest: lotta, tree (that grows and then remains at rest); lutana, moon (whence comes the light that rests on the earth), hence light, as in ludo-wine, white man.

Mata, round like a ball (whirling and then fixed); mata, dead, to die (moving and then still); meta, rope or sinew (used for fastening movable things); mutta, bird (from its plumpness; the mutton-bird is probably the mutta-bird).

Nata, earth, soil (remaining still after being moved); nutiak, to retch (the suffix ak denoting the unpleasant feeling and the peculiar sound).

Retena, heart (with its intermittent motion); riatta, tree (like lotta); rudana, lazy (when in motion, longing for rest); rutta, hard, dry (dried fluid, e.g., mud or blood).

(3) Liquid+guttural—motion+rejection; lagana, foot (put on the ground and lifted up again); laguana, to burn oneself (withdrawing from une, the fire); legana, lugana, water (moving away in stream and ebb); legara, to run away; legunia, dress or covering (removable and warm—une); logune, to cut (making one shrink owing

to the burning sensation, v. laguana); loigana, snake, the fiery serpent.

Magra, megra, day, grass (i.e., that which passes away); mengana, to pull, get (move away from its place); miengpa, to abstain, reject; moga, moka, water; monga, a fly (which is ever ready to go away); mugra, to hide oneself; mukra, spaniel (the swimming beast); mungena, ear (projecting from the head, and originally movable).

Nangumora, (very) far; nenga, canoe (for leaving the land); noki, give me (you give away something); nugara, to drink; nugrina, to vomit (both involving motion of the gullet).

Raka, spear (sent forth); ragi or ragina, white man (the hostile, repulsive moving thing). We find this interpretation confirmed by the word ragi-rappa, a demon who attacks people, a devil; we remember the Chinese denotation of white men as "foreign devils"; rugara, ear (compare mungena); rurga, seaweed used for food (compare nugara, nugrina).

(4) Labial+dental—projection+rest: patina, egg; patrolla, spark, fire (projected, resting); rolla, energetic; there may also be a connection with "crackling"; piterina, sun (as to its rays); poiete, head (projecting from the body, but stationary); potta malitie, freestone (white stone that can be thrown—malitie, white).

(5) Labial+guttural—projection+rejection: pagra, alas! (an utterance of pain); pakara, to fling at (motion and dislike); pakaria, shooting-star; pakaritia, ignis fatuus; panga, leech (an attacking, repulsive thing); pangana, mud (clinging and disagreeable); pegara, to throw; pegi, teeth (acting against each other); pugana, black man, good at attack and defence, hence strong, stout; pugana, five (the "bunch of fives"); pugara, to swim.

(6) Labial+liquid—projection+motion: palla, round, ball, energetic, large, stout, sun; palina, egg (small and round); palana, stars, little sun; pallawa, man, warrior (with wa as suffix of emphasis); penna, spear, man, facetious; piena, leech; poiinta, poienna, point of spear;

parawe, to throw, put, go away; parapa or paraba, whale, porpoise (large, moving); perena (spear); poirina, porpoise; pora, heavy rain; proie, leaf; pruana, smoke.

(7) Dental+guttural—rest+rejection: takani, tagara, to go away (to lift up the foot from its resting position); dogna (= tagana), foot; takira, root, foot of tree; tanga, limpet; tegana, heart (its beating being like rhythmic footsteps); togane, paw, foot; tokana, heel; tugra, thigh; tugana, swift (of foot); tuganik, asleep (the pejorative, ik, implying negation; tugana, to eat (passing from rest to the motion of the gullet).

(8) Dental+liquid—rest+motion: tale, toad, frog (alternately resting and moving); talina, the back (unchanging, but moving as part of the body); talpe, to come, start off; tile, basket (an inanimate thing meant to be carried): toline, bark of a tree (grown fast to the trunk, but liable to peel off); toluna, shoulder (compare talina); tula, thigh, tongue (fixed, but movable).

Tema, hut (movable resting place); time, never (really "always," "resting or moving"; compare the French jamais, which also means "always" (from the Latin jam, magis, i.e., now and evermore, and is used for "never"); tome, to fall.

Tana, was (looking back from the present moment); tanate, mischief (pretending to be resting, and yet moving to do some harm); tene, rib (compare talina); tena, tree-fern (stationary, but growing); toni, tenine, nails on fingers and toes (compare tena); tina, stomach (compare tula); tona, spark; tone, to dive, fall; toni, to call (to cause to move); tuna, winter, really "snow" (the solid, falling thing); tunapi, to know (to have the skill to act).

Tara, to weep, really "to sit down and sway the body in token of grief"; tara, tree (compare tena); tara, wallaby (compare tale); teri, basket (compare tile); terana, terina, bones of skeleton (compare tene). The bones of the body are stationary, but growing. In the skeleton they are chiefly noticeable for being hard and dry. This meaning is transferred to teruna, tro-watta, flint implement; torona, tree, is a form of tra-na; tru, fist is so called from its bony hardness; tura, winter; turana, snow; turela, hail, are forms of tuna.

(9) Dental+labial—rest+projection: tapa, ham; tabrina (= tapa-rina), the back, a prolongation of the ham; tepara, come; tipla, eyebrow; tapleti, tabelti, to travel; this word is supposed to be an imitation of the English equivalent, but it is not probable that that word was used so frequently as equivalent of "to walk," that practically all the tribes incorporated it in their vocabulary. According to our theory, tapleti is simply tap-let-i, i.e., the hams alternately moving forward and resting; takleti would refer to the same action of the legs or the feet; but we find numerous instances of the group pl, and very few of the group kl; the latter seems to have been difficult or disagreeable to the Tasmanians; tapleti would make an excellent substitute for the objectionable takleti. The probability of the exchange is confirmed by the alternative form kableti for tableti.

(10) Guttural+liquid—rejection+motion: kole, to twitch, snatch away; koliena, orphan, whose parents have been taken away. In further confirmation of our remark regarding the group kl, we find that these two words are practically alone in beginning with the syllable kal, kel, kol, etc.

Kami, mouth, teeth, tongue, probably owes its k to the movement of the chin (v. supra); we find many words belonging to this meaning of km, but very few signifying rejection. Of the latter, however, we have a characteristic one; komptena, a spirit of evil, objectionably moving near to human beings, tena being akin to tanate, mischief (v. supra).

Kana, voice, noise, song, speech, evidently belongs to the "chin" group of k sounds. H. Ling Roth's lists give no kan words of the other; indeed, the number of words beginning with k is comparatively small; the sound of rejection is usually found at the end of a word.

Krakne, krakena, to rest, sit down, is made up of kara and the negation k and the suffix ne or ena, which properly belongs to nouns; kara-k would then mean "disagreeable motion? No!" We find kroti (quick motion), kronie (to climb), both implying exertions which the Aborigines disliked.

(11) Guttural+labial—rejection+projection: kupa, good (to give or take). We find kapugi-lia, mouth, and

kepegine, to eat, but these are evidently composed of ka, jaw, and pegi, teeth.

(12) Guttural+dental—rejection+rest: kate, kaita, bad (i.e., do not like it, leave it alone); katala, snake, the bad moving thing; katela or katila, seal, and katina, cow, would also be so called if the Aborigines were at first afraid of them; kote, quick, is akin to kroti (v. supra), but there is a curious development of the idea in koti, little, kaita, dog (small beast), the idea of quickness and smallness being easily associated, and from the idea of "small" we readily pass to that of "pet." Compare also "cat" and kitten." Again, there is a connection between koti and kate (v. supra); as the Aborigines called a good or great man pallawa or pugana, they would naturally call a little thing, kate, bad. Kotube, to tug at a rope, is expressive of the resistance of an inert mass to the action of pulling (— be or pe).

The examples here given will suffice for the purpose of illustrating the principle; their number might easily have been augmented. In some cases the same word was made to serve in two places. This was done because there was a plausible alternative, and because it is quite possible that different speakers named the same thing on slightly different principles. The orthography is that of H. Ling Roth's lists: phonetic, not always consistent, but sufficiently accurate for our present purpose.

It will have been noticed that the interchange of kindred sounds is not detrimental to the clearness of the meaning of words, and that the vowels are remarkably variable.

Before we proceed to the illustration of our theory in the case of longer words, it will be necessary to draw special attention to the variation of speech sounds. Here it is difficult to decide in each case whether the variation is due to the general instability of the Aboriginal orthoepy, or to the difference of dialects, or to the insincerity of the Aborigines, who would probably not be eager to deprive themselves of the means of secret communication with each other, or to the defective perceptivity of the recorders, or to their linguistic idiosyncrasies, or to careless writing or transcription of the original records, or to the printer or his reader.

Still, in most instances, the differences and analogies, taken together, are sufficiently consistent to allow us to formulate some general rules.

We must remember, also, that the language did not spring into existence in the form recorded, though it did, no doubt, begin in a form completely satisfying all the requirements at that time. If my theory is correct, the four words on which all the rest are built show an absolutely primitive form of human speech; previous to it there can have been no linguistic thought, and the utterance must have been confined to inarticulate animal cries. The subsequent word-formation was a subconscious operation, based on heredity, environment, and habit turned to instinct.

The primitive state in which the Tasmanian Aborigines were found by the Europeans, argues that their logical skill had been confined to the immediate needs of their bodies, and that their language was in a similarly primitive state. The four words still sufficed to express their thoughts, and thus their recorded speech carries us back to the beginning of human society.

Thus, the four syllables form the permanent skeleton of the Tasmanian language, and their combinations and variations are the body, which is specifically different in each individual, though generically it is the same in all.

We may now state some general principles of variation:—

(1) Medial and initial g is often elided, replaced by w or y, or represented by o or u.

This phenomenon is observed in several European languages, ranging from Greek to English. In Tasmanian we have, e.g., proguna and pruana, smoke; pruga, paruga, bosom; perenna, spear; and proina, proigh, proingha, broii, proibi, big; ganna and yanna, teeth; ngune, une, wane, fire; kana, wana, ona, to speak.

(2) The places of the vowels are chosen arbitrarily.

We may have prosthetic vowels, as in ali, good, which seems identical with li, moving, alive, useful; anamana, hand, from namana, strong; enganema, eaglehawk, from ngonina, bird, which is in itself derived from naganina or laganina, the small, flapping thing.

Again, we have regularly an epithetic vowel, a, e, or i; every word is an example of this.

Within the word, the vowels found places where they could. We have treinia, terinia, taranienna, triunia for "hard-beaked bird," e.g., owl, crow; ria, rilia, riena, raiana, for hand; raumpta and raumata, for wombat; pengana, panugana, pugrena, pugerinna, for dirt; langana, languna, lugana, langna, dogna, lagerra, for foot; lowanna, nowana, lowa, loanna, loa, loalla, lowla, for woman; leni, loa, liena, lia, lina, for water.

(3) Within their respective groups, the consonants may be freely interchanged. This has already been touched upon, and will be further illustrated in the sequel.

III.—ETYMOLOGY.

It is beyond the scope of our present research to examine all the words recorded by H. Ling Roth, whose list, as has already been stated, may be considered as practically complete. It will be sufficient to deal with such a number of them as will enable a critic to test our theory.

We shall take Norman's list for the Eastern speech, and Milligan's for the Southern, Eastern, and North-Western and Western words. Unfortunately Milligan did not discriminate between the last two dialects, but this is not of great importance, as they have much in common with each other.

We shall find some instances of onomatopoetic words, such as pratteratta, hail, from which we get paratta, ice, frost; but we need not do more than acknowledge the existence of such words, as their connection with our theory is remote, and possibly merely accidental.

Nor need we take notice of evidently interjectional words, for we are not now concerned with the origin of language generally, but with the elements and development of the speech of the Tasmanian Aborigines.

I have dissected some 1,200 Tasmanian words, but shall confine my present discussion to a much smaller number of characteristic specimens, taking, them, generally, in alphabetical order.

THE EASTERN SPEECH.

Bungana, chief—same as pugana.

Bairkutana, horse—par, big; kut, quick; na, nominal suffix.

Kumienna, weak—kami, voice; ienna, diminutive suffix:

Karana, quiet—ka, not; ra, moving.

Kukanna, noise, much talk—kana, voice; ku, reduplication for emphasis.

Krawala, cold—kra, stiff; wala=palla, very much.

Kanara, little (child), magpie—kan, voice; ra, continuous.

Kanaliria, conversation—kan, voice; li, quick; ri, continuous.

Kamina, chin—ka, jaw; mina=pena, projection.

Kuegi, head—ka ka, mouth, jaw, cheeks; the whole face; round; spherical.

Kanawelegana, sing—kan, voice; we, active; leg, rhythmical.

Komtina, dog—ka(m), teeth; tin, projecting.

Kaitagunamena, friend—ka, tongue; tag, foot; namana, hand (in my service).

Kulugana, claw, talon; ka, tooth, (of the) lug, foot.

Kawurrina, bush fire—ka, eating up; wur=pur, solid, ground.

Kotruolutie, baby—kot, little; ruo=nug, drink, suck; lut, white; ie, diminutive. Query: Were the young babies of paler complexion than the adults? It is the case elsewhere.

Koti malitie, young boy or girl—koti, young; ma=pa, very; lit, bright, fair; ie, diminutive.

Lia litea, ocean—li, water; lit, bright, sparkling ripples; ia, diminutive. This appears also in the form of lieltia, rollers on the beach (with white crests).

Liopakanapuna, salt—lia, sea; pug, solid; peun, sharp, burning.

Lagapak, fiddle—lag, leg, stick, bow; pa, moving; k, not getting away; or simply pa ka, moving forward and backward.

Liawe, open—li, move; we, let, make.

Leiemtoniak, ashamed—len, look; ton, downwards; k, bad.

Lackaniampaoik, bandy-legged—lag, leg; nia, bent; pe, stick; k, bad.

Leiriak, bitter—li, water; ri, restless (of the sea); k, bad.

Leware, night—lug, lie; war, ground.

Lalina, day—lin, see; l, reduplicated, plenty.

Lila, gun, waddy—li li, very swift, flying.

Lowanakana, circle—low, woman; kan, sing; the singing women standing or sitting in a circle.

Langta, long, far—len, move on; t stop: a distant point.

Luga perenna, survivor—lug, walk away; pe, very; ren, quickly.

Lugana, foot, oyster—the oyster lies flat like the sole of the foot.

Lowa, woman—lug, foot; wa, active; the woman had to do all the work of the tribe except hunting and fighting.

Lingena, languna, loangare, likangana, likura—wind, to blow; len, continuous motion.

Lietinna, cold water—li, water; tuna, cold.

Liena peuniak, scalding water—li, water; pe, very; un, fire; k, bad.

Lenigugana, stars—len, see; kuka, round things.

Miengpa, abstain—mien=wien, bend, turn away from, not; pa, doing.

Mianabere, kneel—mien, bend; pere, leg.

Mealle, kneel—mial, bend; leg, leg.

Mealli tonerragetta, inactive—mealli, knee; to(ka), heel; narra, very; kita, small, useless.

Mikrakaniak, sick—mie, not; kraka, rest, sleep; k, bad.

• Miengkommenechana, anger—mien, distorted, projecting; kamina, chin; kana, speak.

Munnagana, ankle—mien, bend; leg, foot.

Malitie, white—ma=pa, very; lut, shining.

Mientonka, tumble—mien, bend, knee; ton, fall; k, bad.

Mienintiak, tremble—mien, bend; inti=inni, a little; k, bad.

Marana, battle (few killed)—pa, hit; ren, run.

Monna perenna, sulky, pouting—muna, lips; perenna, projecting.

Manina langatik, steal—ma=mie, not; nina, yours; langt (take) far away; k, bad.

Malangena, child—Ma=mie, not; lag, foot, move, walk; in, dimin.

Manugana, spawn of frog=perhaps the same as malangena, with a possible change from ina (dear little one), to kana, croaker.

Miamengana, battle—mien mien, knee to knee; kana, yell.

Mienemiento, kill—mien, mien, battle; t, stop, strike down.

Mungwenia, grub—mien, bend; wen=pen, stick; i, small.

Mungena, ear — mung = mien = pen, projecting, round.

Mongana, blowfly—Mung, round.

Mungunna, fish—mung-winna, round and long.

Mungienna, porcupine—mung-ienna, round and little.

Mingawina, porpoise—v. mungunna.

Mugana, shag (bird)—mung, round, plump; it may also be a doublet of nagana, lagana, flapping thing, bird.

Mana, a fly—man-a, round, or a contraction of mongana.

Makana, star-fish—mag=mung, round. The transition from man to mang and then to mag is quite natural.

Ni, there, behold! with emphatic k—neka, niga, there; with emphatic r—nara, very, he, she, they, self.

Nune, take—ni, ni, there!

Numbe, here—ni, ni, pe, here indeed; lumbe is a doublet of this.

Nunamara, deduct—Nune, take; mare, one.

Nentega meniawa, yesterday—ni ni, not at all; teg, sleep; mi, I; ni, you; wa, do—when last we were awake.

Naniakana, growl—kana, saying; ni ni, no! no!

Nietta mina, little brother—ni, you; etta, little; mina, my own, my own little one.

Nianti mina, little sister—nia nitia mina, the same.

Nunalmina, father—ni, you; al, good; mina, my own!

Nienna, mother—ni, you; enna, dear little mother.

Neingmina, mother—nienna mina, my own little mother. The addition of the endearing term mina to these words shows again the affectionate, childlike disposition of the Aborigines.

Nelumie, help—ni, you; lumbe=numbe, here.

Nuna mina, good—ni ni, these things; mina, for me!

Noile, bad—no ali, not good.

Nierina, hawk—nie=mie, in a circle; rin, flying.

Narra muna, yes—narra, that; muna, projecting, evident.

Nebele, music—ne=le, lively; pe, make; leg, feet.

Oana, tell, speak—probably from kana; wana would be better spelling; there are so few words in o that they are probably misprints.

Punie, finger nail—doublet of toni (supra).

Plegana, leg—pa, strong; leg, leg.

Pugali, swim—puga, man; li, water.

Poingana, hair—pen, spear, stick; hair dressed in form of sticks.

Puganina, husband—puga, man; nina, that—that man, "he."

Patrollana, musket—patrol, fire; len, flying.

Poiniakana, laugh, facetious—pe, sharp; ia, little; kan, sounds.

Pugoneori, smile—pe, sharp; kan, voice; ali, kind, good.

Rinneaguanettia, dispute—rin, quick; ia, short; kan, words; ettia, trifling things. The form guan for kan supplies the missing link of the series kan, guan, wan, oan.

Riawieak, full (after a meal)—ria, feet; pe, active; ak, with difficulty.

Rinieta, chase—rin, run; ia, hither and thither; t, stop—run till you have it.

Riakuna, dance and song—ria, foot; kana, voice; an Aboriginal ballad.

Tonna, fire, literally, spark—compare with tuna, snow. These contraries have parallels in European languages, e.g., French frire, German frieren, Italian caldo, English cold. It is interesting to find the phenomenon in Tasmanian. Originally tonna, a contraction of tonina, would be a "small, falling thing, and in this respect woudl coincide with tuna, snow.

Tonipeprinna, spark—toni, fire; pe, prinna, fly.

Tentia, red, topaz—ton, fire; itia, dimin.—somewhat like fire.

Tugana, eat—toka, footstep, periodic downward motion. It is possible that tonna, fire, is a contraction of this, as it 'eats up" everything.

Tone, dive—simply "falling," or else "going down with jerky motions."

Tughenapuniak, lean—tug, eat; pun, full; ak, no use.

Weba, weipa, wigetina, wina, winalia, wieta, wita—sun, moon; weiba, wiba, wibia, wieba, man; wia, wiena, wigena, wina, wiwina, winanana, wood, twig. The common root is pe—strong, moving; projecting.

Wuga, wutta, wughta, earth; pug, solid; ta, stationary.

Warra-na, bark of tree, shell, anything curved, blue sky, vault, cloud shape, ghost; pura, pulla, round.

THE SOUTHERN SPEECH.

The words bear the same general character as those of the Eastern speech. The separate list is given because Milligan and Norman based the distinction on the domicile of the Aborigines they examined, and because slight differences of pronunciation may thus be discerned. It is now impossible to assign shades of meaning to particular tribes; but this is immaterial, as the meaning of speech sounds varied in every individual, within definite limits, of course.

Koka, ruddy cheeks, blood, red. This is a reduplicated ka, chin; it would refer to the strikingly red colour of the gums, tongue, etc., and thus assume the general meaning of "red." We have seen kuegi, head, from the same kaka, as the sum of these parts; but its meaning was there referred to shape and position, not to colour.

Kokata, moan, howl—kan, voice, repeated, with t to express the sobs.

Kawuta, evening—ka, red; wutta, earth, at the horizon.

Kraka wughata, stand up—kraka, rest, stand; wugha=pug, firm; ta, stationary. In the East, we find wuga, wughta, for "earth."

Krugana wughata, aloft—wughata, ground; krugana appears also as kroana, to climb, soar; the phrase means "to climb from the ground." In the Eastern speech we find kronie; this might argue that the more primitive forms were characteristic of the South, but the evidence on this point is conflicting; for instance, we have a Southern tannatea (crazy) to compare with the Eastern tagantienna.

Lia mena, lake—lia, water; mien, round, enclosed.

Legara, run—compare legana (supra); the suffix ra often takes the place of na in the South.

Line, house, hut, nest, place—some movable shelter.

Line rotali, encampment—line, abode; rot, dry; ali, suitable.

Loini, liena, bush fire—moving slowly (note the diphthongs).

Lugga kanna, step—lug, foot; kan, sound.

Luggara, fun, sport, dance—lug, foot.

Lunghana, strike, flog, beat—as the ground is struck with the foot.

Lungana, kill—the result of the stroke.

Longhana, longana, sleep—like death.

Lungana, swift—of foot.

Lughra, heat—from running; compare Eastern magra, day.

Lughrata, hot—lugra, heat; t, stationary, permanent.

Lughoratah, summer—doublet of lughrata.

Leghro-mena, perspire—Legro, heat; pen, projecting, exuding.

Mattawebe, firewood—matta, dead; weba, stick.

Mungara, flint—pug, solid. This word also appears as mughra and mora.

Mughra malli, topaz—pug, solid; pa-lut, very bright.

Mora trona, flint—pug, solid; tro, hard.

Mabbile, altogether, quite, many—pa pel, very round, strong, numerous; compare English "roundly," "round number."

Moi, mie, mungie, dead—Eastern mien, bent, round, return, not, heap, sick, feeble.

Moimabbile, battle—Moi, dead; mabbile, many.

Moimutte, skirmish—moi, dead; mutt, heap, i.e., few; if there were many, they could not be seen at once, as if in a heap.

Matta, mutta, moatta, round, heap, spherical, pigeon, plump—pug, solid; t, stationary; compare wugata. The series is pugata, wugata, mugata, moata, muta, mata; as variant, munga.

Munghe mabbleli, a load—mungie, heap; mabbile, big.

Mie luggrata, fever—mie, sick; luggra, hot; ta, lie down.

Mene ruggera, acrid—me, I; ne, not; nugara, drink; compare Eastern tugana.

Moie, muie, muggena, lips, nose—compare the Eastern muna, lips. The two liquids, if they were certain to belong to the root, would well represent the movable parts of the face; we have the Eastern mungenna (ear) and mongtena (eye) to confirm this conjecture. Then, again, we have the Eastern mokena, water, which might refer us to the moist parts of the head. Finally, we have mien, curved, which might refer to the curved outlines of lips, nose, ears, etc.

Nun oine, a greeting—nune, there; wi=pe, active; ne, you.

Nire, good—nara, the very thing (needed), whence also—to heal.

Nirabe, correct—nara, that; pa, indeed; that is it!

Narrawa, yes—doublet of nirabe.

Neka, there—ne, that; ka, yonder.

Neggana, another—neka, that; na, that thing.

Naba, other—na, yonder thing; pa, indeed.

Nubre, eye—doublet of lebrena, leprena, a missile; the power of vision sent forth like a lance; compare "shooting glances."

Narramoiewa, enough—Narra, that; moi, to me; wa, will do.

Oghnemipe, answer—o, prosthetic; kan, speak; mi, to me; pe, do.

In the Vocabulary, p. xx., we find oghnamilee, ask, which H. Ling Roth endeavours to improve to ognamilii (p. lxix.). The true solution is on p. xx., where we find oghnemipe, answer. The oghnamilee is thus evidently a badly transcribed ognamibe. An interesting variant of the word is oangana, inform, tell, evidently a form of kan-kan-a, speak with emphasis.

Pakara, fling—pa, forcibly; kara, throw away.

Papalawe, swallow (bird)—pe pe, very much; li, moving; we, active.

Papla, big—pa pal, very round, stout, strong.

Panubre, sun—pa, big, powerful; nubre, eye.

Pallanubrana, sun—pa, big; la, round, moving; nubra, eye.

Papatongune, thunderstorm—pa pat, loud crash, (onomatopoetic), ngune, fire; or else—pa pa, very big; ton, falling.

Poimatelina, lightning—pe, strike; mate, dead; lina, like a spear.

Pawe, small, rascal—pe pe, mere dot, small; compare German knabe, boy, and English knave, of no account.

Pawawe, small boy—pe pe pe, just a series of dots. We may also refer these two words to the "baby" group (v. supra).

Panubratone, dusk—panubra, sun; tone, set.

Panga, pinga, leech, small caterpillar—pena, lance shape.

Putia, none—paw, little; itia, dimin.; less than little, infinitely small, practically nothing. Here we have a curious possibility of the instinctive perception of the mathematical theory of limits. "Nothing," being an abstract idea, was beyond the grasp of the Aboriginal mind.

Puda, smoke—putia, unsubstantial.

Patingunabe, extinguish—pat, stamp; onomatopetic, though it fits in with our "projection+rest"; ngune, fire; be, do.

Poina, hair (dressed in sticks)), fragrance (issuing forth), entrails (in long strings), pettish (ready to take

the offensive), facetious (compare "shafts of wit"), pune, bird (shooting through the air), pena, lance.

Poenghana, laugh—pen, facetious; kan, voice.

Pallakanna, shout—mighty voice.

Poiete, head—pena, erect figure; ita, stop, end, diminished.

Poetarunna, skull—poet, head; ren, running, smooth.

Poetakannapawenea, whisper—poet, head; kan, voice; paw, small; ne, away, towards someone.

Poieta kannabe, talk—poet, head; kan, voice; be, active.

Poira kunnabea, talk—a doublet of the same; instead of ita we have the rarer diminutive ira; ina is more common; bea, like nea in the previous word, has an epithetic a.

Rialanna, air, breeze—ri, moving; len, along.

Rallana proiena, gale—rallana=rialanna; proiena, big. Rallana may also have affinity with ralla, strong.

Rotuli, long, tall—rot, dry, hard; li, long: grass. We may also refer it to rot, dry grass, ali, good.

Ranna murina, inactive—ren, move; mur, heavy; in, somewhat: somewhat heavy or slow in moving.

Ranga, knee—ren, flexible joint.

Raggamutta, lame—ranga, knee; mutta, thick, stiff.

Roatta, hurt, injured—from raga wutta=raga mutta.

Ruete, lazy—doublet of roatta.

Riatta, gum tree—motionless thing, standing stiff-kneed.

Retakunna, creak (of limbs of trees)—riatta, tree; kan, voice, sound.

Tramutta, pebble—tra, hard; mutta, thick, round.

Trowatta, pebble—doublet of tramutta.

Tawe, tape, takawbi, go—taka, heel; pe, active.

Tikotte, hunger—tug, eat; kote, quickly, eagerly.

Turra, winter, snow—doublet of Eastern tuna.

Toina, hawk, pelican; tanna, owl; tene, rib—doublets of pene, lance.

Uratte, frost, hoar-frost—doublet of waratte, paratte (Eastern).

Una, fire—doublet of wina, stick, firewood; or of ngune, from nagana, the "eater up," or even from ngonina, nagana, the flickerer, flapper.

Ughana kanna nire, true—oana, speak; kan, word; nire, good.

Warra, bark of tree—palla, round, shell, "pallium."

Warrane, blue sky—warra, vault.

Warrena, warrentinna, cloud in sky—warra, rounded mass; tin, extensive.

Waratte, hoar-frost. There seems to be an interesting interchange of meanings. Paratta, waratta are onomatopoetic, from the prattling noise of hail or the crackling of icicles; but the ice forms a covering, like bark, and so we have the warra family of words, in touch with palla, parra, round.

Warrawa, spirit of the dead—warra, cloud, apparition; wa, active.

Wina, fuel, stick, taste, feel, try, wake—pena, stretch out, active.

Wia lutta, red charcoal—wia, wood; lut, bright, shining.

THE WESTERN AND NORTH-WESTERN SPEECH.

Here we have some striking characteristics, different from those of the Eastern and Southern words; but, when allowance has been made for these, the words are found to be essentially the same.

We notice at once a softer pronunciation of the consonants, b, d, g, for the Eeastern p, t, k. We also have the nominal suffix, lea, to take the place of the Eastern na. As a specimen of the extraordinary spelling occasionally used by the recorders, we may note i-aynghlalea (bad), which seems to stand for the Eastern wiena-na (crooked). Such spelling might make the whole of the record doubtful but for the fact that there is a certain consistency underlying the spelling, which enables us to establish fairly reliable conclusions. We must bear in mind that the climate and physiographical features of the West and North-West are singularly like those of the West of Scotland, Wales, and Ireland, and we need not be surprised if the intonation and articulation of the

speech of Western Tasmania bears some analogy to that of the Gaelic, Welsh, and Erse. The following words are assigned to the North-West:—

Eribba, cockatoo—e, prosthetic; li, flying; pa, active.

Kocha, swan—ka ka, repeated cries; or like Southern kuegi, round.

Karkuka, parrot—ka ka ka, the same; the cries would prevail in this case.

Kaumilea, evening—compare Southern kawuta, red ground.

Kunrare, much talk—kan, voice, jaw; re-re, continually moving.

Kunmunera, much talk—kan, noise; mun, mouth; ra, continuous.

Talba, devil; Eastern palla wa—strong, active, man, fighter.

Terriga, walk—toka, foot, with r as infix of motion.

Loyoranna, wind—li, swift; ren, moving.

Murdunna, star—par, pal, sun; tinna, diminutive.

Loina, sun—len, radiator, eye.

Longa, ground—lug, resting place.

From the Western Vocabulary we take:—

Benkelo, bullock—This form of pakalla, with the native infix n, seems strong evidence against the derivation from "bullock."

Belanilea, shadow—pal, solid; ni, not; lea, suffix.

Boabennitia, grin, make faces—pa, make; pen, laugh; itia, playfully.

Gannemerara, come here—kan, call; me, I; ran, run.

Gdulla, acid, sour—kot, little; ali, good.

Gnimuckle, aged—kan, teeth; mu, lips; k, bad; le, suffix.

Illetiape, rouse him—i, prosthetic; le, quick; tape, come.

Marama, star—pal, sun; inna, little.

Lulla, foot—lug, foot; lea, suffix.

Lugh, foot—lug, without suffix.

Lola, gun—le-na, spear, striking at a distance.

Lullabi, loallibe, ship—lulla, foot, oar-beat;; pe, active.

Lugra nire, right foot—lug-na, foot; nire, good. It is significant that a distinction of usefulness was made between the right foot and the left. In Milligan's list, we find in the Eastern Vocabulary—luggana elibana, right foot; lug, foot; ali, good; pa, strong, luaggan aoota, left foot; lug, foot; wutta, heavy. In the Southern—lugga worina, right foot; lug, foot; war—pal, strong; lugga oangta, lug, foot, wang=pen, stick, stiff; ta, stop, not elastic. In the Western and North-Western—malleare, right foot; pal, strong; lea, suffix; re, moving, foot; oolatyneeale; left foot; pug, foot; lea, suffix; ta, not elastic; no, not; ali, good. We note also the shortening of the syllables in the Western words.

Lialarragonna, sneeze—lia, quick; lanna, sharp; kana, sound.

Lanne, strike—len, swift motion.

GENERAL VOCABULARY.

The NUMERALS are given by H. Ling Roth thus (p. 133):—

ONE—marawah, mara, marrawan, borar, parmere, pammere, marai, par-me-ry.

TWO—piawah, poi-erinna, pyanerbarwar, calabawah, boulah, kataboure, bura, cal-a-ba-wa.

THREE—luwah, wyandirwar, aliri, cardia.

FOUR—pagunta, wullyawah, cardia.

FIVE—puggana, marah, karde, kardia.

TEN—karde-karde.

According to my theory of the Tasmanian speech, these words are far less perplexing than they appear here, and would show that the Aboriginals had no conception of abstract numbers, but merely of such notions as big, little, arm, hand.

Anything noticed individually or rather, "pointed at," was pa, in some form or other, with emphatic repetition and nominal suffix ra or na.

In the case of the hand or fist, a collection of five fingers which could be displayed or hidden, puga-na (solid, strong) would be the natural expression, while "four" would be a hand with the thumb invisible, that is stopping short of completeness, expressed by puganta, fist cut short.

Mara, "one" or "five," is also "the complete thing, one fist made up of five fingers," therefore palla, round, strong.

The number three would be expressed by the word for "arm," the limb with three parts, two for the arm and one for the hand; lu-pa, li-pa, strong limb, and the reduplicated a-li-ri, limb with hand, are words for "arm" and for "three."

The number two was also beyond the grasp of the Aboriginals. They could see a thing divided into two or more parts which were smaller than the whole had been. Now, "small" was expressed, as we have seen, by pawe and by koti or kata, and we find these words, in some form, in all the numbers after unity. As an alternative, we find for "two" boulah or bura; these are forms of pala (big), and express the duad as an increase in bulk, not as a cutting up into smaller parts.

Wullyawah (four) is another form of this, with the magnifying or perhaps duplicating pa as suffix.

The diphthong in piawe, which we see again in poierinna, pyanerbarwar, wyandirwar, may well indicate a splitting up of a whole by the change from the single vowel sound to a composite one.

Calabawah is probably a misprint for katabawa, which is simply kata + pawe; we note the form katabouve in confirmation of this conjecture.

Karde, or its diminutive form kardia, is simply kate (small); the more parts there are the smaller will be their size.

Using uniform orthography, we get, therefore, the numerals in these forms:—

ONE—pala-pa, pala, palapa, pala, pa-pala, papala, pala, papala.

TWO—piawe, piawe-r-inna (with euphonic infix r and diminutive suffix), pia-na-pawe, kata pawe, pala, kata pawe, pala, kata, pawe.

We note the frequency of the duplication of the whole word, most appropriate in this case, and not found in any other number but "ten," which means "two fives."

THREE—ri-pa, pia-na-pa, li-ri, katia.

FOUR—pagan-ta, pal-ia-pa, katia.

FIVE—pugan-a, pala, kata, katia.

TEN—kata-kata.

The PERSONAL PRONOUNS recorded by H. Ling Roth (p. 184) may also be simplified.

Mina, I, me, mine, has been accounted for.

Ni-na, na-ra (nard is evidently a misprint for nara), neka, mean the "non ego," "that thing," "thou, he, she, it, you, they."

Warrandur is given for "we;" but it is doubtful whether the Aborigines could grasp a collective notion; e.g., they had no plural, and no word for forest, tribe, family. H. Ling Roth quotes from La Billardière and Péron—tagari-lia, my family; but their informants had spoken of squalling babies; tagara means "to weep," and tagara-na, weepers.

A more plausible explanation is that warrander (as Norman wrote it) is a form of warrane, which means anything curved; and its application to "we" was perhaps due to the circumstance that Norman, addressing one or more Aborigines, pointed to each in turn, beginning or finishing with himself, to indicate the present company (the we), and the latter only noticed the circular motion of his finger, and told him this was warrane (a circle), whereupon he put down warrane as the equivalent of "we."

Thus, on considering the numerals and the personal pronouns, we again find the lowest possible stage of human thought, and that the four words again sufficed to express all that was required.

IV.—SYNTAX.

H. Ling Roth, in his discussion of the Tasmanian language (pp. 178 ff.), bases his remarks on the syntax chiefly on Fr. Müller's Grundriss der Sprachwissenschaft. As has been stated in the introduction, the present investigation is confined to the original records; but it may be pointed out, that from our dissection of the words it seems that these words themselves were phrases, and that there is no trace of systematic accidence or syntax.

In my Introduction to the study of the Aboriginal Speech of Tasmania, read on the 16th November, 1908, before this Society, I translated a song which has fortunately been preserved in three versions. For the sake of completeness and brevity, I repeat one of the versions. The literal translation was:—"Mighty, run, fire, heel, my, speedy, foot, my, speedy, thou, come, run, bird, thou, very, great-man, man, very, great-man, hero." This was rendered in plain English thus:—"With might runs the bush fire; my heel, too, is speedy, and my foot is swift. Come thou, and run with the speed of a bird! Thou art a real warrior, a man indeed, a warrior, a hero!"

In the records we have some phrases translated. I will briefly refer to them.

Wilkinson's translation of a portion of Genesis is very short, and mixed with English words. We take the first four verses as specimens:—Trota, Godna pomale heavena coantana. Lewara crackne. Godna carne, tretetea, tretetea crackne. Godna capra tretetea lewarra.

Godna and heavena are evidently English words. Capra is probably a misprint for lapra (see). Trota is a curious word. The mental development of the Aborigines had not advanced to abstract ideas; so they could not tell Mr. Wilkinson the word for "beginning." Then he probably laid a row of stones on the ground, pointed to the first one, and asked what that was. He would expect the equivalent of "beginning," and the Aborigines told him it was trota or trowatta, a round stone or pebble! We let it pass as meaning "beginning," and retranslate literally thus:—"Beginning God make heaven earth. Dark rest. God speak light, light rest. God see light dark."

Milligan's sentences (pp. xli.-xliii.) give us little further light; their general characteristics are the same as we have already discussed, with the possible exception of ta being used as a postposition, as in mito (to me), neeto (to thee), nangato (to the father); its literal meaning is "stop there." It is even possible that this shows that postpositions were earlier than prepositions; but the basis of such a contention is as yet very frail.

Indeed, in Milligan's sentences we meet with indubitable datives without ta, e.g., Teeanymiape tuggane, Meeongyneeome—Give me some bread to eat, I am hungry. We dissect the phrase thus:—tiana, heap, give; mia, me; pe, do; tugana, eat; mie, not; nagana, eat; me, me.

In a previous sentence, Milligan had Loina tyennabeah mito—Give me a stone. We dissect—lena, stone; tiana, give; pe, do; mi, me; to, stop.

Fenton, in his History of Tasmania, has a very interesting extract from a sermon delivered by G. A. Robinson to the Aborigines, with an interlineated translation. This document must have escaped H. Ling Roth's notice. Robinson's intimate acquaintance with the Aborigines makes this record very valuable.

Matty nyrae Parlerdee. Matty nyrae Parlerdee.
One good God. One good God.

Parleeva nyrae, parleeva loggernu, taggerar
native good, native dead, go

lowway waeranggelly. Parlerdee lowway
up sky. God up.

Nyrat raegee merrdy, nueberrae Parlerdee
Good white-man sick, looks God

waeranggelly, Kannernu Parlerdee. Nyrae
sky speaks (prays) God. Good.

Parlerdee neuberrae nyrae raegee timene
God sees good white-man no

merrydy. No-ailly parleeva loggernu, tageera
sick. Bad native dead. goes

toogunner, raegorroper, uenee maggerer
down evil-spirit fire stops.

Parleeva tyrer, tyrer, tyrer. Nyra parleeva
Native, cry, cry, cry. Good native

maggerer Parlerdee waeranggelly, timene
stops God sky, no

merrydy, timene taggathe.
sick no hungering.

The spelling is peculiar, but the words can easily be identified. The phraseology is that of a man who had learnt to adapt his thoughts to those of his hearers. The translation is so far inaccurate as it implies accidence in the Tasmanian words, e.g., in speaks, sees. We note that his word for God is Pallerdee, that is palla ritia, powerful white-man! The first word (matty, one), is not in H. Ling Roth's list; it is evidently the same as matta—round like a ball, a pebble. If Robinson tried to get the native word for "one," he would probably take up a pebble to illustrate his meaning, and duly receive the information that it was matta, a pebble, which he then would remember as the numeral "one," not realising that the Aborigines had no proper numerals at all.

In Appendix D, H. Ling Roth gives some "Phrases and Songs after Braim." There is an English version for the phrases, but it is not accurate; there is none for the songs. I will take phrase 5 as a specimen. Adopting the uniform spelling and interlineating my own version, based on H. Ling Roth's lists, we get:—

Malangtena mena take mulaga. Puti nara
child stop me go hunt. Not there

pamere lugana lika lugana krakane
one kangaroo like kangaroo exist

kate kate, ludawine pallawana nara
many, White-man warrior there

mokera nara mena lugana. Ritia teratittia
dog there me kangaroo. Man white

tape tialena nara lowe, relbia mena
go come there down violent act me

malitiena mabile. Warrawe poietanate.
white many. Spirit distracted.

H. Ling Roth quotes as the English version:—When I returned to my country, I went hunting, but did not kill one head of game. The white men make their dogs wander and kill all the game, and they only want the skins.

A free but essentially more accurate version would be:—When I go hunting in my native place, I find not one kangaroo where there were wont to be many. The white warrior is there; his dogs are where my kangaroos were. The white man goes and comes there and lies down to sleep. The white man has done many acts of violence to me; my heart is broken.

In Braim's songs, a characteristic phenomenon is the presence of a multiplicity of hyphens. These indicate the rhythmical tune and drum-beat to which the words were sung, as we have observed in Mrs. Fanny Smith's song. Two songs will suffice for the present, to which I will add my version. The first is:—

A re-na-too
Ket-a-ta-e-vepa
Mel-re-pa-too
A re-na-too.

In our spelling, we get

A rena to
Keta taipewa
Mebrepa to (Mel is an error)
A rena to.

This means: O, run hither (to me) Little one, do come! Fly to me! O, run to me!

The second is:—

Ne-par-me-ry-wa
Ne-cat-a-ba-wa
Ne-par-me-ry-wa
Ne-cat-a-ba-wa.

This is characteristic of the child-like mind of the Aborigines. The words are merely:—Ne pamerewa, ne katapawe, twice over, and their meaning is:—"Here is one, look! here are two!"

CONCLUSION.

It would be easy to add further examples in illustration of my theory, for the material available is surprisingly ample; and my notes are copious; but it does not seem necessary to do so.

Throughout this demonstration, the arguments have been based on general principles which apply to all languages. It would have been feasible and interesting to trace analogies between the Tasmanian speech and other languages, but it was necessary to confine our attention within narrower limits.

A reader acquainted with the Greek dialects will no doubt recall many instances of interchange of consonant, of infixes, and of instability of vowels; and similar phenomena can be discerned in other languages. Indeed, some of the roots seem to be of almost universal occurrence.

What I have endeavoured to do is to find the principles by which the speech of the primitive race of the Tasmanians was governed. It seems that the languages of the Australian continent are far more developed; however, this is a subject for further research.

It is curious to note the absence of spirant and sibilant sounds from the Tasmanian speech, and also from that of the Maori of New Zealand. The latter language is of very elaborate structure, and has been said to be akin to the Japanese. I do not possess sufficient information to be able to discuss this point, but it would certainly be interesting to discover, in case of such affinity being proved, how the Maori came to be without spirants or sibilants in their speech, while the Japanese still have at least some of them.

The study of the Tasmanian language is hardly begun; but, if that language really represents the very beginning of human speech, its investigation cannot fail to excite great interest among the scholars of the world.

It seems at least probable that, as the individual and social life of the Tasmanian Aborigines was demonstrably at the lowest stage of human activity, their language, too, would be almost primitive and but one step removed from the inarticulate cry of an infant. This consideration has incited me to endeavour to reconstruct the ancient speech of Tasmania.

NOTES ON THE OCCURRENCE OF A FOSSIL TREE EMBEDDED IN DRIFT ON THE NORTH-WEST COAST OF TASMANIA.

By T. Stephens, M.A., F.G.S.

(Read 12th July, 1909.)

Some forty years ago I brought under the notice of this society the Tertiary marine formation near the mouth of the River Inglis, and the underlying stretch of moraine matter, with large erratics, which extends eastward for a distance of about five miles. As a result of a recent visit to this part of the coast I have to report the occurrence, off Woody Hill, near low-water mark, of a relic of the ancient forests of Tasmania preserved under somewhat peculiar conditions.

The eastern boundary of the above-mentioned glacial drift, so far as is yet ascertainable, is nearly opposite the residence of Mr. C. J. Mackenzie. Here the ancient slates and schists come prominently into view at low tide, and about half a mile eastward they rise in a low bluff and pass under the basalt of Woody Hill to the south. To the east of this bluff in the hollows between the ridges of the ancient rocks, which are highly inclined and have a northerly strike, are masses of consolidated drift of a totally different character, the rolled pebbles in which are only such as might be derived from the indurated sandstones, slates, and schists that are the bed-rocks of the whole coast, and therefore they are probably of local origin. This drift has been extensively denuded by the force of the seas breaking upon the shore during the gradual elevation of the coast line in comparatively recent times, but probably extends southward under the low sand dunes and alluvium which lie to the east of Woody Hill. Whether it is more recent than or anterior to the basalt of Woody Hill, which is of late Tertiary age, is at present uncertain.

Partly embedded in this drift, which at one time must have deeply covered them, are the fragmentary remains of a large fossil tree with an estimated length of not less than sixty feet, the bulk of which has been removed by denudation. The external appearance somewhat resembles that of the fossil wood often found in the upper members of our Permo-Carboniferous series, but in this case the woody structure has not been silicified, and the attempts which I have had made to polish sections for closer examination have not been successful. There is much variety in the outer portions of exposed fragments of the tree. Iron sulphides replacing the organic tissues and becoming subsequently oxidised seem to have been the petrifying agents, and there are traces here and there of white iron pyrites (marcasite), or arsenical pyrites (mispickel) still unaltered. The latter is very abundant in the coal measures of the Mersey district. Some portions have all the appearance of siderite. The interior of the tree seems to have been little affected by the infiltration of iron in any form, and much of it is practically identical with ordinary lignite. Judging from the arrangement of the stumps of branches, the form of the tree must have resembled that of a pine, and faint indications of markings like the "pits" which are the distinguishing feature of coniferous wood may be seen here and there, but no definite conclusion can be come to under this head until after careful microscopical examination. All that can be said now is that the tree is probably a pine belonging to the Tertiary period, and that it came down some ancient river from the country now drained by the River Cam to its present position, where it ultimately with the gradual subsidence of the land became deeply embedded in the drift.

Apart from the question of the history of this fossil tree, I take the opportunity to mention that, not far away, there is a group of large boulders resting on the upturned edges of the ancient rocks which have all the appearance of ice-borne erratics. They are more than half-a-mile distant from what I have described as the eastern boundary of the glacial drift, and their presence here calls for future investigation. Forty years ago there were numbers of massive boulders of granite, and of altered sandstones and limestones with fossils of

silurian type, partly embedded in the till between Woody Hill and Table Cape. At the present time I can find only two of them remaining, the rest, as I am informed, having been broken up for use as road metal!

As a postscript to this paper I have to report the receipt from Mr. Twelvetrees, Government Geologist, to whom I had sent specimens of the fossil tree, of a letter in which he says that "the wood seems to be Tertiary. It is filled with marcasite, which has decomposed largely to iron oxide, and it is now highly ferruginous." Mr. Twelvetrees also encloses a note from Mr. H. H. Scott, of the Victoria Museum, Launceston, who says of one of the specimens that "it proved, upon microscopical examination, to be a fairly fine-grained pine. Much of the structure was obscured, but the presence of pyrites here and there gilded some of the tissues and left the details visible." Mr. Scott also suggests that from the arrangement of the "bordered pits" the tree appears to have belonged to the larger division of the pines, and not the more ancient Araucarian section."

PRELIMINARY NOTE ON THE ROCKS USED IN THE MANUFACTURE OF THE TRONATTAS.

By Fritz Noetling, M.A., Ph.D., etc.

(Read 12th July, 1909.)

The observations here recorded are based on the examination of more than 5,000 specimens, all collected by myself chiefly in the southern and central parts of Tasmania. The results derived from the study of such a large number may be taken as fairly accurate, yet I must consider them as preliminary only, because they are solely dependent on macroscopical observations, while the very important microscopical examination is still outstanding. I am aware that this is a serious drawback, but the results obtained without the aid of the microscope are full of interest, and they will be a great help to those who may eventually take up the microscopical part.

Brough Smith (1) was probably the first who recognised the nature of the rocks used by the Aborigines for their implements, but it was left to Mr. Johnstone to ascertain the fact that "the cherty rock from which the natives of Tasmania for the most part manufactured their flints was undoubtedly derived from upper palaeozoic mudstones, which are frequently metamorphosed into a cherty substance by contact with the later eruptive greenstones" (2). Localities where this particular kind of rock occurs are not uncommon, and most of them, if not all, have been habitually visited by the Aborigines in order to obtain suitable pieces of rock.

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(1) The Aborigines of Victoria, London, 1878, Vol. II., Appendix, pages 400 and 401.

(2) Geology of Tasmania, Hobart, 1888, page 334.

In a paper previously read before this Society (1) I have demonstrated that another, probably still more important source where suitable substances were obtained from are the gravel deposits of glacial and recent age. It is needless to say that the pebbles contained in these gravels are in a secondary position, and they must have been derived from outcrops similar to those which were used as quarries.

If the metamorphic theory is correct, it stands to reason that there must be a considerable number of varieties of cherty rocks. A metamorphosed sandstone must be considerably different from a rock whose origin is a shale. But not only are the primary rocks widely different in chemical composition, but each kind, whether sandstone, shale, or anything else, varies considerably. The cement which binds together the grains of quartz in the sandstone may be calcareous or silicious, and, above all, the percentage of iron varies considerably in each class of rock. It is therefore a priori very probable that a large number of varieties as to colour and other physical qualities must be the result of metamorphism, and I wish to deal in this paper with the main types that can be distinguished.

Whenever a collection of native stone implements is made in the island, and such collection be sorted afterwards, it will be found that two large groups can be distinguished at once, viz.—

1. Volcanic rocks,
2. Metamorphosed sedimentary rock of a highly siliceous nature.

Though I propose to deal here only with the siliceous rocks, it will be advisable to say also a few words about the volcanic rocks. One fact becomes conspicuous at once—not a single chipped implement has been found that is manufactured from a volcanic rock. All the chipped implements, the tronattas s.s., are invariably manufactured from the siliceous rocks.

Not in a single instance has this rule been broken, and the reason for this is, as we will see later on, quite

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(1) Notes on a Chipped Boulder found near Kempton, "Pap. and Proceed. Roy. Soc., 1908."

obvious. The implements made of volcanic rocks, mostly if not exclusively of Diabas, consist of rounded natural pebbles, which were partly used as hammers, partly turned into sacred stones, and natural pieces of columnar Diabas most probably used as choppers, but they were never subjected to the elaborate flaking of the cherty rocks.

The tronattas were exclusively manufactured from cherty rocks, and even the untrained collector will notice a large variety of colour. There are specimens of a deep jet-black, and others of a dazzling white; there are rocks of a blood-red or a bright yellow colour; there are others of a grey tinge, and those of a more indifferent colour are too numerous to mention. In fact it seems that all the colours of the spectrum are represented except that which is so common in another island of the Pacific, the green of the New Zealand stone implements.

On closer examination it will be noticed that besides the colour there are other differences in the appearance, and after a short time the observer will be able to distinguish at least four different main types of the siliceous rocks. These are:—

1. Chert, or preferably called Hornstone (1).
2. Porcellanite.
3. Breccia.
4. Other siliceous rocks not included under the above headings, such as Chalcedony, Wood-Opal, Fossil Wood, Quartz.

1. CHERT OR HORNSTONE.—This is generally a finely-grained rock, showing a dull lustre, but a fine conchoidal fracture. Its colour varies from a light grey to almost jet black. Dark grey and bluish tinges are the most frequent; light grey is somewhat rarer; and a dark reddish-brown colour is the rarest of all. On the whole the colour of the hornstones is somewhat dull, and the bright tinges exhibited by the next group have so far not been observed among the hornstones. Fre-

(1) Dana, System of Mineralogy.

quently the colour is streaky, darker and lighter coloured bands regularly alternating, particularly in the grey varieties.

Tronattas made of hornstone are unquestionably the most common. As stated in a previous paper, hornstone was obtained from Clarke's quarry (Mount Communication), Johnstone's quarry (Coal Hill, Melton-Mowbray), Hutchison's quarry (Front shelves run, Beaufront, Syndal), Nichols' quarry (Melton-Mowbray), and probably also from Bisdee's quarry (Great Lake) and Walker's quarry (River Plenty). At most of these quarries a dark blue hornstone was obtained, only at Nichols' quarry and the eastern part of Hutchison's quarry a grey hornstone occurs. This seems to indicate that the blue hornstone is of more frequent occurrence than the grey one, a fact which is borne out by the number of implements manufactured from either rock.

The hornstone has a peculiar chemical feature not observed in the other kinds of rocks used for implements; when exposed to the action of the atmosphere it becomes coated with a peculiar earthy-looking crust of whitish or more frequently yellow or rusty-brown colour. This "patina" so completely covers the rock that it is frequently impossible to ascertain its true colour without breaking the specimen, or at least striking off a small particle. There can be not the slightest doubt that the patina is the result of a superficial chemical decomposition, the more soluble elements were removed, while the less soluble, in particular iron and alumina, were left behind. But not only do the stone implements show this crust, in a still higher degree is it exhibited by the rock as found in the quarries in situ, where it often attains as much as three-quarters of an inch in thickness.

The tronattas are usually covered with a thin patina only, which in no way obliterates the sharp edges produced by chipping. There are, however, other specimens in which the patina has reached such a thickness that the original chipping begins to disappear. There can be no doubt that the thickness of the patina is a function of time, and the thicker it is the older is the implement. Unfortunately no data are available to estimate the number of years it takes to form a patina of a certain

thickness. The process must, however, be a very slow one. At Maryvale I found some specimens which were unquestionably re-chipped. Though this must have been done at the very least 75 years ago, the later fractures did not show even a trace of patina, but exhibited the deep jet-black of the hornstone, strangely contrasting with the whitish patina which covered the whole surface. This being so, I doubt whether we will ever be able to ascertain this factor, because it is unquestionable that centuries must lapse before any patina of any appreciable thickness is formed. There is, however, no doubt that if by the combined work of generations this factor could be ascertained, one of the most valuable data for the estimation of the length of the past would be obtained.

When exposed to the action of blown sand, the hornstone takes a fine polish, exhibiting a peculiar shiny lustre, quite different from the original dull one. Blown sand, however, apparently prevents the formation of a patina.

The heat of fire affects the hornstone in a peculiar way; the surface becomes covered with a number of fine cracks, generally running in parallel lines, and connected by short cross cracks. It appears that these cracks are only superficial, and never penetrate deeply into the stone. If such a cracked hornstone is exposed to the air parts of its surface commence to break off, leaving a rough jagged surface, which greatly differs in appearance from the even, smooth surface produced by flaking. There is no doubt that in this way the finest tronatta can be destroyed beyond recognition.

The natural crust which is still preserved in a number of specimens is always more intensely affected by the heat than the original stone. It breaks into a number of irregular polygonal pieces, strangely resembling a tesselated pavement in miniature.

Hornstone flakes exceedingly well, and with a little practice large flakes, showing a fine, flat face and a sharp cutting edge can be struck off a larger block. There can be no doubt, however, that in certain instances the blow must have been carried out with tremendous force. The largest specimen I have so far found measures 7.4

inch in length, having a weight of 3½lb. It is safe to assume that this specimen was struck off a block of much larger size, and, what is still more remarkable, the plane face (pollical face), which has a superficial area of about 17 square inches, cuts the lines of stratification at a right angle. If the cleaving had been done along the line of bedding it might perhaps be easier to understand how such a large plane could be the result of a single blow; but as it cuts it at a right angle, the blow which struck this specimen off must have been administered with tremendous force. It is probably the fine flaking qualities that made the hornstone the favourite material used for the tronatta, and there can also be no doubt that the valued "mora trona," the black flint of the vocabularies, specially refers to hornstone.

While the true cretaceous flint of Europe is a sedimentary siliceous rock, the hornstone of Tasmania is of different origin. Primarily it is a sedimentary rock,but this sedimentary rock has subsequently been altered by the eruption of volcanic rocks such as diabas or basalt.

According to the nature of the original rock, a large number of varieties were produced, but foremost of all are dark blue and grey varieties, showing an extremely fine banded texture. For the present I am unable to say anything about the original rock, because none of the quarries shows the gradual passage from the unaltered to the highly metamorphosed rock; but there is every probability that the original rock was a finely-grained, thinly-bedded shale, such as occur in the coal measures of Permian age.

I have taken the specific gravity of 19 specimens of hornstone collected at different localities, which are given in the subjoined table:—

1.	Grey Hornstone, from Mona Vale	2.500
2.	Blue Hornstone, from Mona Vale	2.506
3.	Blue Hornstone, Syndal Quarry	2.610
4.	Reddish Brown Hornstone, Mona Vale	2.616
5.	Blue Hornstone, Syndal Quarry	2.631
6.	Blue Hornstone, Mona Vale	2.644
7.	Dark Grey Hornstone, Mona Vale	2.645
8.	Dark Blue Hornstone, Kempton	2.666
9.	Blue Hornstone, Kempton	2.679

10.	Grey Hornstone, Mona Vale	2.681
11.	Dark Blue Hornstone, Mona Vale	2.701
12.	Grey Streaky Hornstone, Melton Mowbray	2.701
13.	Blue Hornstone, Johnstone's Quarry, Melton Mowbray	2.703
14.	Grey Streaky Hornstone, Melton Mowbray	2.735
15.	Blue Hornstone, Johnstone's Quarry, Melton Mowbray	2.746
16.	Blue Hornstone, Mona Vale	2.750
17.	Blue Hornstone, Johnstone's Quarry, Melton Mowbray	2.761
18.	Grey Hornstone, Nichols' Quarry, Melton Mowbray	2.780
19.	Light Grey Hornstone, Mona Vale	2.847

The above figures prove at once that the Tasmanian Hornstone is rather a heavy rock; the average specific gravity being 2.687, it will be seen that only two specimens are under 2.600, while all the others are well above this. The figures for specimens obtained directly from the quarry are rather interesting. They are for:—

Hutchison's Quarry, Syndal—a very dark blue hornstone—

(3) 2.610.
(5) 2.631.

Johnstone's Quarry, Coal Hill, Melton Mowbray—a dark blue hornstone—

(13) 2.703.
(15) 2.746.
(17) 2.761.

Nichols' Quarry, Melton Mowbray—a grey hornstone—

(18) 2.780.

These figures seem to indicate that the hornstone from different places varies somewhat, and that, strange to say, the light grey variety is the heaviest of all, while the dark blue stone found in Hutchison's quarry is, contrary to expectations, the lightest of all. On the other hand, the figures for one and the same locality vary, and I am afraid that, however tempting it may be to ascertain the locality from which a certain implement came by means of the spec. gravity, it is impossible to do this for the present.

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2. PORCELLANITE.—This is a much coarser grained rock than hornstone, always showing a shiny waxy lustre, thereby strongly differing from the dull hornstone. Its colour varies from a pure white to almost black; most frequent are red, yellow, and brown tinges; grey is not infrequent, the dark tones being the rarest; sometimes several colours, for instance red and yellow, alternate, and the rock becomes streaky.

Tronattas made of porcellanite are much less frequent, and so far I know of only two localities where porcellanite is found in situ. One is near Pontville station, and this was used as a quarry (Weston's Quarry); the other is an outcrop near Maryvale, which, however, was probably never worked. In Weston's Quarry the colour of the rock varies from white through grey and red.

Porcellanite never shows a patina, and this proves that its chemical composition must considerably differ from that of hornstone.

The fracture is conchoidal, and some of the porcellanites flake as well as hornstone; yet it was a much less favourite rock than the latter. I believe the reason for this is the coarser grain, because tronattas made of porcellanite are generally never so elaborately worked as those of hornstone.

Blown sand does not affect the porcellanite as much as the hornstone. Of course it also gets the peculiar coating due to this cause, but inasmuch as it has a shiny lustre of its own, the blown sand does not affect it much.

The heat of fire acts quite differently on porcellanite. Instead of a multitude of superficial cracks there are only a few, which divide the rock in small polygonal pieces of rather peculiar appearance, such as are found in Weston's Quarry, near Pontville station. If exposed to a very strong heat porcellanite apparently loses its waxy lustre, and becomes dull; at the same time the surface gets covered with a glassy coat.

Porcellanite is, like hornstone, a metamorphosed sedimentary rock, and at Pontville it can be distinctly seen that it is an altered sandstone. Opposite the railway station the western hills are formed of sandstone,

and immediately on the other side of the line the porcellanite occurs, which in its turn is followed by Diabas. Though the line of contact is not clearly seen, there can be no doubt as to the true relations of Diabas, porcellanite, and sandstone. The specific gravity of 12 specimens is as follows:—

1.	White Porcellanite, Weston's Quarry, Pontville	2.308
2.	White Porcellanite, Weston's Quarry, Pontville	2.346
3.	Red Porcellanite, Melton Mowbray	2.362
4.	White Porcellanite, Weston's Quarry, Pontville	2.382
5.	Grey Porcellanite, Melton Mowbray	2.500
6.	Grey Porcellanite, Mona Vale	2.506
7.	White Porcellanite, Melton Mowbray	2.522
8.	Red Porcellanite, Weston's Quarry, Pontville	2.558
9.	Brown Porcellanite, Old Beach	2.566
10.	Pink Porcellanite, Kempton	2.578
11.	Reddish Grey Porcellanite, Kempton	2.654
12.	Dark, nearly black Porcellanite, Mona Vale	2.700

The average specific gravity is 2.498, and the above figures seem to indicate that as a rule the coloured varieties are heavier than the white ones, and that the darker tinges are again heavier than the lighter ones. If these few figures permit of such a conclusion, it seems that the specific gravity increases with the following scale of colour:—

Lightest Heaviest
White .. Grey .. Red .. Brown .. Black

As the colour is unquestionably dependent on a certain percentage of iron, this peculiarity explains itself.

3. BRECCIA.—Under this heading I include all those siliceous rocks used in the manufacture of tronattas in which angular fragments are embedded in a finely-grained matrix of different colour. The colour of both fragments and the matrix varies a good deal, but most common is a yellow or brown matrix containing lighter-coloured fragments.

The fracture is splintery, and, though a little conchoidal, the breccia does not flake as well as hornstone or porcellanite.

Like porcellanite, the breccia never develops a patina, but when exposed to blown sand it takes a fine, smooth polish. Fire acts differently on breccia—in fact the result is more like that of chalcedony than of either hornstone or porcellanite. The whole specimen is covered by numerous cracks, intersecting each other in all directions, but apparently not penetrating deeply into the interior.

Breccia is much less frequently used for implements then either of the foregoing rocks, and I never found a specimen showing careful chipping on the indical face. All tronattas consisting of breccia are of the crudest types. I think that this is due to the inferior quality of the fracture, but in particular to its splintery nature.

Breccia does not seem to occur very frequently. Only one actual outcrop is known to me, at Droughty Point. The rock occurs here in large, loose blocks and boulders, lying near the shore on the top of a volcanic rock. There is no doubt that this occurrence has been made use of by the Aborigines, though it cannot be termed a regular quarry, but the ground close to these boulders contains a large number of implements which have been manufactured from this breccia. Mr. Stephens kindly told me that there is another occurrence near Ulverstone, and it appears that the tronattas found near Devonport were derived from that source.

Geologically speaking the breccia is perhaps the most interesting of all. There can be no doubt that the Droughty Point breccia must be considered as a deposit of hot springs. In fact it is a silica sinter, as is conclusively proved by the fine banded texture of the matrix.

On the other hand, the beautiful black and white breccia from Mona Vale appears to be a true breccia porphyry. Here the molten magma penetrated through a conglomerate, breaking it up into angular fragments, which floated in the magma, and became thereby metamorphosed. It further appears that a certain group of rocks found near Margate, which I provisionally classify

with the breccia, is a really micro-crystalline porphyry of yellow colour. It is impossible to decide these questions without a microscopical examination, but should this be carried out the most interesting results are certain to be obtained.

I determined the specific gravity of 11 different pieces, which gave the following figures:—

1.	Red Breccia, Droughty Point	2.540
2.	Brown Breccia, Droughty Point	2.588
3.	Grey Breccia, Droughty Point	2.590
4.	Red Breccia, Droughty Point	2.610
5.	Brown Breccia, Droughty Point	2.616
6.	Brown Breccia, Droughty Point	2.621
7.	Red Breccia, Bellerive	2.653
8.	White and Black Breccia, Mona Vale	2.654
9.	Grey, Streaky Breccia, Droughty Point ..	2.655
10.	Red Breccia, Droughty Point	2.686
11.	Brown Breccia, Droughty Point	2.782

The average specific gravity is 2.636, but it does not seem that there is a connection between colour and specific gravity. The range is apparently a much smaller one, as there is only 0.242 difference between the lightest and the heaviest variety examined.

4. OTHER SILICEOUS ROCKS NOT INCLUDED UNDER THE ABOVE HEADINGS, SUCH AS CHALCEDONY, QUARTZ, WOOD OPAL, FOSSIL WOOD.

This group includes rather a heterogenous mixture of siliceous minerals, which have been provisionally placed together. It is remarkable to note that not a single implement made of any of this mineral has come under my notice which shows a good finish. All the specimens are of the very crudest type, and generally mere fragments only. The reason is obvious. None of them except wood opal shows that fine conchoidal fracture which is so essential for a good tronatta. Chalcedony in its numerous varieties has a very splintery, rough fracture, which is still stronger in the ordinary quartz. Wood opal has a fine conchoidal fracture, but

it appears that it is too soft for rough use. Anyhow, none of these minerals played an important role in the economic life of the Aborigines.

The heat affects these minerals in a way quite different from hornstone or porcellanite. In wood opal the fire produces a few cracks, which appear to penetrate deeply into the interior. The cracks are rather irregular, fairly wide apart; in somewhat this comes closest in appearance to hornstone, but the cracks are more irregular, further distant, and deeper.

Very different is the appearance of the white, milky chalcedony. This is intersected by a large number of irregular cracks running in all directions, and penetrating through the whole mass of the specimen. A more brownish rather transparent chalcedony shows the same features, part of the surface is broken off, and instead of the smooth surface produced by flaking, it is rough and jagged.

These pieces of chalcedony resemble very closely to the famous cracked flints from the Oligocene of Thenay in France; in fact, the darker specimen can hardly be distinguished from the European ones.

The examination of 11 specimens gave the following results for specific gravity:—

1. Opaque Wood Opal, Maryvale	1.940
2. White Chalcedony, Maryvale	2.289
3. White Chalcedony, Baskerville	2.433
4. Milky Opaque Chalcedony, Mona Vale	2.436
5. Fossil Wood, Mona Vale	2.465
6. Wood Opal, Mona Vale	2.533
7. Chalcedony, Melton Mowbray	2.583
8. Do., Melton Mowbray	2.592
9. Do., Melton Mowbray	2.606
10. Fossil Wood, Droughty Point	2.666
11. Milky Quartz, Mona Vale	2.680

The average specific gravity, if it be permissible to take it of such a heterogenous group, would be 2.472.

Before proceeding any further, I must explain why I never mentioned the hardness. The old method of determining the hardness of a mineral or a rock is a

most crude and unsatisfactory one. If determined in this way, all the rocks and minerals here enumerated have exactly the same hardness, namely, that of quartz; that is to say about seven, though this would probably represent the maximum. The hardness of the rocks here mentioned ranges between 6 and 7, though most will be about 6.5 to 6.75, but it would be absolutely impossible to distinguish the finer grades, which are certain to exist. If determination of hardness were made, it should be carried out according to the more improved methods suggested by Rossival, but this is a very tedious operation, which requires a lot of mechanical appliances not at my disposal. It is therefore unnecessary to make a special reference to the hardness, because it must be a matter of course that rocks consisting mostly of silica must have a hardness closely approaching to that of quartz. I fail to understand why under these circumstances Herr Klaatsch could have stated that the rocks used in the manufacture of tronattas were rather soft. This is by no means the case —in fact some of the grey hornstones appear to be harder than flint, the ordinary material of the European rocks. Herr Klaatsch's statement is one of those superficial observations by which this author has gained rather a notoriety, and in this particular case his erroneous opinion is either due to insufficient mineralogical knowledge or insufficient material, or both.

When we compare the specific gravity of the rocks here mentioned we obtain some rather interesting results. Taken as a whole we have:—

1. Hornstone.—Range, 2.500—2.847; difference, 0.347; average, 2.687.

2. Porcellanite.—Range, 2.308—2.700; difference, 0.392; average, 2.498.

3. Breccia.—Range, 2.540—2.782; difference, 0.242; average, 2.636.

4. Others.—Range, 1.940—2.680; difference, 0.740; average, 2.472.

It will be seen that the breccia shows the smallest difference between extremes, while that of the fourth group has, as might be expected, the largest. Hornstone and porcellanite show a fairly wide range, which

seems to indicate a rather varying composition of the original rock from which they are derived. Hornstone is the heaviest of all, and it is closely followed by the breccia, while there is a considerable difference between these two and porcellanite, as will be seen from the following figures:—

Hornstone, 2.687;
  Difference, 0.051.
Breccia, 2.636;
  Difference, 0.138.
Porcellanite, 2.498;
  Difference, 0.022.
Others, 2.472.

According to these figures there is less difference in the specific gravity of the more pure siliceous minerals and the porcellanite than between the porcellanite on the one side and the breccia and hornstone on the other. If a conclusion can be drawn from this, it seems to indicate that the porcellanites are a fairly pure siliceous rocks with a comparatively small admixture of other substances, while in the breccia, but particularly the hornstone, the percentage of non-siliceous matter must be fairly high.

If we compare these rocks to other substances, the following table of specific gravity will be of interest:—

Obsidian buttons, average 2.388, maximum 2.500, minimum 2.312.

Fragment of white glass, 2.424.
Fragment of green bottle glass, 2.674.
Flint Salzinnes (Belgium), 2.565.
Flint St. Symphorien (Belgium), 2.535.

The heavy weight of the green bottle glass is most conspicuous, and, as we know that this is chiefly due to the high percentage of iron, the conclusion I have drawn with reference to the hornstone and breccia is well supported.

Now, if we take the specific gravity of the cretaceous flint to be 2.500—2.600, we can arrange the rocks here described in a very illustrative table. They are:—

SPECIFIC GRAVITY.

	Number of Specimens.	Less than 2.400	From 2.401 to 2.500	From 2.501 to 2.600	From 2.601 to 2.700	From 2.701 to 2.800	From 2.801 to 2.900
Hornstone ...	19	0	0	2	8	8	1
Breccia... ...	11	0	0	3	7	1	0
Porcellanite ...	12	4	1	5	1	1	0
Others	11	2	3	3	3	0	0
Total	53	6	4	13	19	10	1

If calculated in per cents, this table can be condensed to a little one, particularly if we assume three groups of specific gravity in comparison to flint, viz., lighter, equal, and heavier than flint. We have then

	Specific Gravity lower than 2.500 lighter than Flint.	Specific Gravity 2.500 to 2.600 equal to Flint.	Specific Gravity more than 2.600 heavier than Flint.
Hornstone... ...	nil	10.5 %	89.4 %
Breccia	nil	27.2 %	72.7 %
Porcellanite ...	41.6 %	41.6 %	16.6 %
Others	45.4 %	27.2 %	27.2 %
Total	18.8 %	24.5 %	56.6 %

This table is of the greatest interest, because it proves that the majority of the rocks used for the manufacture of the tronatta were considerably heavier than flint, from which the European eolithes and archaeolithes were made.

These figures will be more illustrative still if we compare the ratio of frequency of the different kind of rocks used in the manufacture of tronatta. The following figures are arranged according to localities:—

	Geilston per cent.	Old Beach per cent.	Shene per cent.	Melton-Mowbray per cent.	Mona Vale per cent.	Mount Morriston Trefusis per cent.	Maryvale per cent.
1. Hornstone	52.4	62.2	79.4	86.8	86.9	89.9	90.9
2. Porcellanite	26.2	16.3	11.8	7.3	9.6	7.8	4.5
3. Breccia ...	14.4	13.5	2.7	0.7	0.0	0.0	2.2
4. Others ...	7.6	7.9	5.9	5.1	3.4	2.3	2.3

The average figures, based on the examination of such a large number as 5,000 specimens, conclusively prove the preponderance of hornstone. We may say almost eight out of every 10 tronattas are made of hornstone, and, in comparison to it, the use of the other rocks is insignificant. Next to hornstone comes the porcellanite, while the use of breccia and other rocks is very limited.

The figures obtained for these seven localities are rather interesting, inasmuch as they seem to prove that the selection of the rocks was influenced by local conditions. In the neighbourhood of Hobart, where hornstone is rather rare, while porcellanites and in particular breccia are common, the last two rocks show a much higher percentage than at any other place. There is no outcrop of hornstone known to me near Hobart—certainly not one that has been used by the Aborigines. The nearest quarries—Clark's Quarry, or Mount Communication and Walker's Quarry, near Plenty, are about 20 to 22 miles in a straight line. Johnstone's and Nichols' Quarries are about 30 miles distant. Unless we assume that the Aborigines broke the stone at these quarries and carried it to their camping grounds, near Geilston and Old Beach—a view which is not very probable—we must suppose that they collected the rough stone locally in gravel deposits. The proportion in which the different rocks occur in these deposits is therefore reflected in the above figures. Where quarries were handy, at places like Mona Vale, Mount Morriston—Trefusis, and Melton Mowbray, the hornstone was used in preference to all other rocks. It seems, however, remarkable that at Shene, but particularly at Maryvale,

where no quarry is known to be near except the porcellanite outcrop (Weston's Quarry) near Pontville, the percentage of hornstone reaches the highest figure, and that, though a porcellanite quarry was handy, the percentage of that rock is not more than 11.8 per cent. of the total. This seems to prove more than anything the preference for the hornstone.

To me all this seems to show that though the hornstone was by far the most valued rock, and if possible was used in preference to any other, porcellanite and breccia were made use of only when the supply of hornstone was not ample.

Now, if we compare how many specimens would be lighter, equal, and heavier to flint, according to the above figures for the frequency of occurrence we find that

	Average percentage of Frequency.	Specific Gravity lighter than Flint.	Specific Gravity equal to Flint.	Specific Gravity heavier than Flint.
Hornstone ...	78.35 %	nil	8.30 %	70.04 %
Breccia	4.78 %	nil	1.30 %	3.47 %
Porcellanite ...	11.93 %	4.97 %	4.97 %	1.98 %
Others	4.91 %	2.30 %	1.33 %	1.33 %
Total	100 %	7.27 %	15.90 %	76.82 %

In comparing this table with that on page 15, it seems at the first glance that there is a great discrepancy between the ratio of lighter, equal, and heavier than flint. It must be borne in mind that the 53 specimens whose specific gravity was determined were not selected according to the proper ratio of occurrence. In order to bring the two tables in harmony I ought to have ascertained the specific gravity of 78 hornstones, 12 porcellanite, 5 breccia, and 5 others, or at the reduced ratio of say 16—3—1—1, while the actual determination was made at the ratio of

Hornstone.	Porcellanite.	Breccia.	Others.
2	1	1	1

In other words, if the determination of the specific gravity had been carried out in proportion to the frequency of occurrence, I ought to have determined it off 16 pieces of hornstone and 3 pieces of porcellanite for every one piece of breccia, and others that I examined. But instead of this I weighed only two pieces of hornstone (that is to say, one-eighth of the number that should have been examined) for one piece of breccia and others.

This explains, therefore, the difference in the figures, and it is obvious that those of the last table represent the actual figures. If I therefore collect 100 tronatta there will be

Heavier than flint 76 specimens, composed of 70 hornstone, 3 breccia, 2 porcellanite, 1 other.

Equal to flint 16 specimens, composed of 8 hornstone, 1 breccia, 5 porcellanite, 1 other.

Lighter than flint 7 specimens, composed of 0 hornstone, 0 breccia, 5 porcellanite, 2 others.

Therefore, taking weight for weight, 100 tronatta were considerably heavier than 100 European implements of exactly the same size.

The above investigation has conclusively proved that there is a great variety of rocks used in the manufacture of the tronatta. This variety of substances stands in a sharp contrast to the monotony of the material used in the manufacture of the European implements. For eolithes and archaeolithes nothing else but the well-known flint of cretaceous age was used, at least as far as I can judge from the collections at my disposal. The eolithes from the Mafflien, in Belgium, seem to form the only exception, inasmuch as a dark blue hornstone, somewhat resembling that from Johnstone's or Hutchison's quarry, has been used. Variety of material and monotony of the same are the chief distinguishing feature of an otherwise undistinguishable collection of eolithes and archaeolithes from Tasmanian and Europe.

NOTES ON THE NAMES GIVEN TO MINERALS AND ROCKS BY THE ABORIGINES OF TASMANIA.

By Fritz Noetling, Ph.D., Etc.

(Read 9th August, 1909.)

The enquiry into the name given by the Aborigines to their stone implements led naturally to a further enquiry into the names of rocks and minerals distinguished by that race. The result is interesting enough; in several instances the literal meaning of the words used would be ascertained, and the meaning of other words which were rather a puzzle could be made out with a tolerable amount of certainty.

Though primarily meant to be a collection of the names of minerals and rocks, it was unavoidable to discuss other subjects which apparently had no direct connection with minerals. Yet these studies throw such a curious light on the mental condition of the Aborigines, that, instead of being a mere collection of names, this paper rather deals with a number of questions connected with the life of this primitive race.

I need hardly to say that I am not a trained philologist, and some of my deductions may be wrong. If so, I shall be only too pleased if anyone who has got a better knowledge than I will correct me. The matter is of great importance. The more we learn, even about the mental capacity of the Tasmanian Aborigines, the greater will be the assistance rendered to the study of the archaeolithic race of Europe.

It will perhaps be best to review the native words for minerals and rocks, irrespective of their nature, in alphabetical order, in order to establish some facts to go on with (1).

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(1) It will also be noticed that a few substances such as charcoal or red ochre, the first of which is certainly not, and the second of which can hardly be called a natural produce, are included in this list. However, both being closely connected with some of the minerals, I thought it better not to omit them from the list.

1. COAL.—I can only find one word for coal, viz., "Conara," in Calder's vocabulary, who quotes d'Entrecasteaux as his authority; but it is apparently not contained in any other vocabulary.

Coal was of no value to the Aborigines, and it is more than probable that they took very little notice of it. As, however, coal seams crop out closely to the sea shore at the localities visited by d'Entrecasteaux, there is every probability that a specimen lying amongst the rubble on the beach was found by him or his men, and its name ascertained by questioning an Aborigine.

2. CHARCOAL.—Though not exactly a mineral, I find it convenient to include this substance in my list. According to Milligan the words are—

Eastern Tribes—Maweena.

Southern Tribes—Loarra.

La Billiardiere and Peron both use the word

Loira,

stating that this means charcoal reduced to powder, with which they cover their bodies. Now, there is no doubt that Loarra and Loira are identical, but it will be seen that this word is very different from that one as used by the Eastern Tribes.

Now, one of the most characteristic features of charcoal is its blackness, and if we look up under the heading "black" we find—

Eastern Tribes—Mawback and Mawbanna.

Southern Tribes—Loaparte.

We also find

Dirty=mawpa and mawpack.

"Dirty" and "black" are therefore synonymous, exactly as "clean" and "white."

In the words for "black" we have undoubtedly the same words as those used for charcoal, and we may therefore take it that there existed no proper name for charcoal; it was simply called "(the) black" from its

foremost quality, and in its ordinary condition it was called

Mawee-na.
Mawi-na.
Mawba-na.
Mawback.

When powdered it was probably

Loa-ra.
Loi-ra.
Loa-parte.

It is remarkable that there is so little similarity between the words for coal and charcoal, two substances which are so very alike as far as colour is concerned. There may be a connection between

Co(n)a-ra and
Loa-ra,

but this requires further proof.

3. CLAY AND EARTH.—Milligan gives the following words:—

(a) Clay.

Eastern Tribes—Pannoga-na malittye.
Southern Tribes—Pappalye mallee.

(b) Dirt (mud of whitish colour).

Eastern Tribes—Panoga-na maleetya.
Southern Tribes—Manna-na mallye.

(c) Dirt (mud dried).

Eastern Tribes—Penga-na rutta.
Southern Tribes—Manna-na rulle.

(d) Dirt.

Eastern Tribes—Penga-na.
Southern Tribes—Manna-na.

(e) Earth (mould).

Eastern Tribes—Penga-na.
Southern Tribes—Manna-na.

Two more words for earth, viz.,

Gunta (Dooe)
Natta (M'Geary),

are quoted by Ling Roth. In the Tasmanian English Dictionary it will be found that "gunta" does not mean earth in the sense of a mineral, but rather the ground on which men are standing. the word "nata," or "natie" is given with the same meaning, and we may therefore omit both, not representing a mineral. From the above list it will be seen that the primary words are

Penga-na,
Manna-na,

from which all the others are derived. They apparently mean "surface soil" of any kind. The Aborigines did not know the meaning of the word "dirt;" everything was "earth" to them, hence we find dirt and earth as synonymous.

If we examine the derived words we have a

Panoga-na } maleetya
Pen(o)ga-na }
Manna-na mallye.

As the second word means white or whitish, these words mean a clay or earth of whitish colour, and a reference to the vocabulary shows that the word "rulle" means "rough."

Literally, Pengana rutta or Manna-na rulle means "rough earth," and as dried clayey soil is pretty "rough," it may also stand for dry "mud."

The words which stand for clay show at once that they mean a whitish substance, and in the word Pannoga-na we have no trouble in recognising the word Pen-ga-na. It is more than probable that Pappa-lye is the same word as Manna-na.

We therefore come to the conclusion that the surface soil in general was called by the

Eastern Tribes—Pen-ga-na,
Southern Tribes—Man-na-na.

If dried and rough it became rutta or rulle, and a special kind of argillaceous soil or rock—a white clay—was distinguished under the names

Pan-(o)ga-na maleetye
Man-na-na mallye.

It is very probable that the heavy loamy soil resulting from the weathering of volcanic rocks was the Pen-ga-na or Man-na-na, considering its wide distribution all over Tasmania. The whitish clay, the Pan-oga-na maleetye and the Man-na-na mallye most probably represent the pipeclay so frequently found. It is therefore unquestionable that these words refer solely to an argillaceous soil.

4. CRYSTAL.—In Calder's Vocabulary two names are given under the heading crystal, viz.,

Southern Tribes—Keeka.
Northern Tribes—Heka.

There can be no doubt that both words are identical, but it is impossible to say what kind of crystal they refer to. The most probable theory is that they stand for quartz-crystal, though crystallised quartz is by no means of frequent occurrence in Tasmania. We must, therefore, leave the meaning of the word an open question.

5. FREESTONE.—This is the popular name given to that kind of rock which is geologically known as "sandstone." The sandstone of Tasmania is almost exclusively, if not all, of Permian age, and some of its varieties form an excellent building stone. In fact, before the introduction of the kiln-burnt brick it was the only building stone used in Tasmania. The houses were either constructed of wood or the more substantial ones of freestone. This rock played therefore an important part in the life of the early settlers, and it is hardly to be wondered at that they enquired for its native name.

Milligan gives the following names:—

Eastern Tribes—Boatta or potha malleetye.

Southern Tribes—Potta mallya.

North and West Tribes—Ponin-galee.

We see at once that it is a compound word, and the word as used by the Eastern and Southern tribes leaves no doubt that the attribute means "white" or "whitish." "White potta," the freestone was called by the Aborigines, and as far as colour goes this attribute is qnite correct.

I am afraid, however, that it will be impossible to arrive at the meaning of potta, or po-ta. The suffix "ta" is frequently found in other words, and probably the correct spelling of the freestone would be

Po-ta-male and
Po-nin-galee.

Though the suffix "nin" in the word used by the Northern and Western tribes differs from that used by the others, there can be no doubt that po-nin-galee is practically the same word as po-ta-malee.

6. IRON ORE.—Iron ore is fairly common in Tasmania. Large pieces of limonite occur at numerous places in the weathered diabas—for instance, on the Brighton Plains, near Shene. Layers of impure sandy ore are pretty common in certain permian sandstones—for instance, near Baskerville, on the Macquarie River; and last, but not least, the fine haematite ore on the Penguin River, is well known. Iron ore was apparently greatly valued by the Aborigines as the substance which they turned into red ochre by roasting.

Milligan gives the following words:—

Eastern Tribes—Latta.
Southern Tribes—Lattawinne.

The suffix "winne" occurs in numerous words, and its meaning is not quite known yet. The real word for iron ore is undoubtedly

La-ta,

in which we again find the same suffix "ta" as in the preceding po-ta.

7. RED OCHRE.—As this substance has formed the subject of a special paper, it is sufficient to mention its name only.

Milligan gives the following:—

Eastern Tribes—Ballawinne.
Southern Tribes—Balla-winne.

We know that the suffix "winne" is unimportant, and that the proper name is therefore

Ba-la.

I only wish to draw once more the attention to the remarkable likeness of the Tasmanian word for blood, viz.,

Ba-loo-ina,

and the word for red ochre. If we separate balawine in the following way—ba-law-ine—the similarity is so striking that there is every probability that the Tasmanian name for red ochre means nothing else but "blood." La Billiardiere gives another name for ochre, viz., ma-la-ue (1), which in the Tasmanian-English vocabulary is spelt

Ma-la-ne,

and translated as "yellow ochre" according to Peron. Disregarding the suffix, we would have two kinds of ochre, viz.,

Red ba-la-(wine).
Yellow ma-la-(ne).

I may remark here that in the dialect of the Southern tribes the name for canoe was

Ma-la-na (mallanna).

The similarity between this word and that for yellow ochre is very remarkable. It is difficult, if not impossible, to say whether there is not some mistake at the bottom of this. I cannot find any reference to the use of "yellow ochre" by the Aborigines, and this being so, it is hardly probable that they would have distinguished a substance which not only is of rare occurrence in Tasmania, but was also of no use to them, under a special name.

8. HORNSTONE OR CHERT.—As this substance formed the subject of a special paper, in which all the different rocks coming under this heading have been discussed, I need not go into further detail. The Aboriginal names were—

Eastern Tribes—Trona,

and a special kind of this trona, probably the dark blue or grey variety, was called

Mora trona.

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(1) Considering the French pronunciation of the letter "u," the last syllable comes nearest to the English wee-e; ma-la-ue, might perhaps be transcribed as ma-la-wi(n)e.

The meaning of the word tro-na is not known, except that it represents a siliceous rock, which the modern scientist calls hornstone or chert, and that it also included such substances as porcellanite, breccia, and a number of quartz minerals such as chalcedony, wood opal, etc.

9. PEBBLE (Rolled Quartz).—Under this heading Milligan gives two words, viz.,

Eastern Tribes—Kugha-weenya
Southern Tribes—Tramutta.

At the first glance we perceive that under this heading two most heterogeneous objects are included. The second word is no other than the general name for stone implement, viz., trowatta. No doubt a pebble of rolled quartz can be, and may often have been, turned into a trawatta; but there can be also not the slightest doubt that this name was not applied to designate the substance. We can therefore disregard this word.

The remaining kugha-weenya presents such a similarity with the word for "topaz" that it will be better to discuss it there.

10. SALT.—It seems one of the most striking features of the Tasmanian vocabulary that there exists no special word for one of the most necessary substances of human life, namely, salt. Human beings cannot exist without salt—a fact too well known to be further enlarged upon. How is it, then, that the Tasmanian Aborigines could do without it, though as a substance it must have been well known to them. For instance, the salt pans near Mona Vale are after a dry season completely covered with a glittering white crust of dry salt, and as this part was apparently one of their favourite camping grounds, they could not help noticing this when water became scarce. There is also no doubt that they noticed the salt on the rocks left by the evaporation of sea water.

I think the explanation of this apparently lack of desire for one of the most important substances is very simple. During winter time the food of the Aborigines consisted mostly of shell fish, which naturally contained

sufficient salt to satisfy all cravings of the body for this substance (1). Thus, taking the salt required for the process of life already included in their daily food, there was no reason for them to specially collect it (2).

Milligan mentions the following words for salt:—

(a) Salt on the rocks by the sea side—
Lienowittye.

(b) Ditto—
Liopackanapoona.

(c) Water (salt)—
Lia noattye.

If we begin with the first word,

Lieno-wittye,

we see that it is composed of the word for water lia or liena(o) and the suffix wittye. It is very probable that "wittye" is the same as "winne;" the word would therefore read

Lieno-winne,

and would perhaps mean a "a substance that comes from water," salt being the residue after the evaporation of sea water. I am not quite so certain about the second word, except that it also contains the lia(o) water, and therefore indicates that the word has some connection with water.

The most interesting of all is, however, the third, the word for salt water—

Lia-noattye.

According to F. Mueller, the negative is expressed in the Tasmanian language by the word "noia;" if affixed to a word it would convey just the opposite meaning. Now, we find that water pure and simple is

Lia-winne or liena, the last word apparently being contracted from

Lia-eleebana.

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(1) I have not tested them, but I am told that limpets (Patella), and even mutton fish (Halioties), are so salty that if eaten they will, even if well cooked, produce an intense feeling of thirst.

(2) The question may well be asked, How did the archaeolithic man of Europe obtain the necessary salt? Is it possible that he, like the Tasmanians, frequented the sea shores?

The attribute "eleebana" apparently expresses a particular emphasis of the good qualities of something. Lia was water; lia-eleebana particularly good water. Now, I do not think that the sense of taste of the Aborigines was so highly cultivated as to distinguish different qualities of water. Good water was any water that was fit for drinking, though, in the opinion of modern man, this same water may be disgustingly dirty. Lia-noia or lia-noattye was bad water—that is to say, unfit for drinking purposes, however clear such water may have been. Now we can fully understand the origin of the third word, which stands for "salt water." Arriving at a waterhole or passing a creek a European would probably ask his native guide, Is this fresh water? The Aborigine would reply, Lia-noattye, meaning thereby, "This is water not fit for drinking." The European would promptly taste it, and, finding its taste saline, would jump at the conclusion that lia-noia or noattye means salt water, while it really had no association with the word "salt" at all.

11.—SAND.—Sand forms one of the most conspicuous features of the Tasmanian landscape, particularly along the sea shore. Sandy soil was the favourite camping ground of the Aborigines, but only two words are contained in the vocabularies to denote sand, and even one of these seems doubtful.

Milligan gives the following words:—

Eastern Tribes—Mungara mena.
Southern Tribes—'Nguna.

The second word is unquestionably incomplete, as the main part, the root, is evidently missing. It is, however, the first one which is the most curious. The word "mena" is apparently a suffix, and the main part is the word "mungara." This is exactly the same word that has puzzled me when discussing the native words for stone implements (1). Milligan states that the Southern tribes used the word mungara to denote "a flint." If that be so, it is hardly probable that the Eastern tribes used exactly the same word to denote "sand." One of

(1) The Aboriginal Designations for Stone Implements, Pap. and Proceed. Roy. Soc. Tas., 1908.

the two must be wrong, and there is a great probability that the translation "a flint" is wrong. The second word, 'nguna, which could also be written 'ngana or 'ngara seems to indicate that the word for sand in the dialect of the Southern tribes must be similar to that of the Eastern tribes. It is therefore very probable that

Mun-ga-ra or
Mun-ga-na

is the Tasmanian word for sand.

Considering that the largest and favourite camps are always situated on nice warm sandy soil, it might be expected that the word for "camping ground" might give a clue.

Milligan gives the following words for encampment:—

Eastern Tribes—Lena wughta rotaleebana.
Southern Tribes—Line rotali.

We know that the word eleebana in particular ro(o)t-eleebana an emphasis of the good qualities, is frequently used, and it is therefore certain that the words

Lena wughta
Line

really express the word for camp, and rotali or rotaleebana simply mean that lena wughta or line are exceedingly good.

Ling Roth literally translates

Lena	wughta	rotaleebana
hut	earth	long,

meaning thereby that on such places more permanent structures were erected. (It has been shown on pp. 107-111 that the natives constructed two sorts of huts or break-winds—those which on the ramblings of small parties were to last for a night only, and those more permanent ones to last for a season; hence the last-named—viz., the above word—explains itself. Aborig., p. 189.)

It would be out of place to go here into the discussion of the correctness of this statement, but it is certain that "rotaleebana" was never applied in a chronological

sense to denote the length of a period. Wherever found, it emphasises the good qualities, but not bad ones.

Admitting that the word "wughta" stands for "earth," that is to say in the meaning of ground or soil, we come to a quite different translation if we assume that "lena" means "water." The literal translation is, therefore, according to my opinion,

lena wughta rotaleebana
water soil very good.

Now, what is the meaning of this? To anybody who has actually seen the camping grounds there cannot be the slightest doubt as to its interpretation. A warm sandy soil was a most essential feature for a camping ground, and to make it perfect it was necessary that it should be close to fresh water (liena or lin'-eleebana). Soil and water being satisfactory, such a locality was chosen as a camping ground, and it is only too natural that the primitive mind of the Aborigines should choose those two qualities which were most essential to them to express the name of the locality. Water and soil being good, it must be a satisfactory place to dwell on, argued the primitive mind, hence its designation for encampment grounds. This is certainly a more probable translation than "the huts of earth constructed for long duration."

Unfortunately, however, this interpretation of the word for camping ground does not contain any indication of the word for "sand." If the soil, the ground, the "wughta," was good, this presumed that it was of an arenaceous nature, but this does not throw any light on the meaning of the words mun-ga-ra and mun-ga-na. These words may stand for sand along the shore, but their literal meaning is at present unknown.

12. TOPAZ.—Under the above headings Milligan gives the following words:—

Eastern Tribes—Tendeagh.
Southern Tribes—Mugramallee.

It will at once be seen that two completely different substances are enumerated under the same English heading.

The first word means "red," while in the second we find the word for "white" (mallee). The first was therefore a "red" and the second a "white" mineral. Now, whatever colours occur in topaz, red topazes are of such rare occurrence, and to my knowledge only found in Brazil, that it is hardly probable that this variety was distinguished by the Aborigines of Tasmania under a special name.

I think it more probable that one of those interested in the collection of native words showed a cornelian to an Aborigine, and the latter simply replied "tendeagh," meaning thereby "red." As it is pretty certain that mineralogical knowledge was not the strongest point of the early settlers, the cornelian stone was mistaken for a topaz.

Topazes occur in Tasmania, as it is well known; and it is probable that the second word, indicating a "white" stone, really refers to topaz. On the other hand, we had under the heading pebble (rolled quartz) the words kugha weenya. There seems to be a certain similarity between the words "mugra" and "kugha," but I am unable to say whether this view is correct or not. The scarcity of topaz pebbles in Tasmania, except Flinders Island, suggests the idea that "mugra" rather means quartz, perhaps chalcedony, or even wood opal (1) than topaz.

However that may be, it is certain that under the heading topaz two widely different minerals were included. The first is a red one, most probably cornelian; the second a white one, most probably quartz or chalcedony, but most unlikely topaz.

13. DIABAS, BASALT, & ARCHAEAN SCHIST.—In a paper previously read before this Society (2), I expressed the opinion that the words

Lenn-parenna
Leni-carpeny
Loan-tennina
Noan-yale

(1) Occurring in fine white opaque pieces near Mount Morriston.

(2) The Aboriginal Designations for Stone Implements, Pap. and Proceed. Roy. Soc. Tas., 1908.

represented certain Tasmanian rocks, most probably diabas and granite. I am now in the position to confirm this opinion—in fact, it is now possible to make out the meaning of the first and last word, and as the remaining two are in all probability identical with the first, the problem has been satisfactorily solved.

Lenn-parenna

is unquestionably a composite word, and at least two words are known to me in which the word "parenna" forms the attribute. These are

Matta-perenna=Penis
Commena-purrenah=beard.

The first of these two words is composed of matta=ball=testicles and

Perenna=spear.

the second of

Commena=chin, and
Purrenah spear.

We have, therefore,

Matta—perenna
Ball—spear=pennis
Cemmena—perenna
Chin=spear=beard.

The last composition is rather illustrative; the bristles growing on the chin look like tiny spears. Now, if we analyse the word

Lenn-parenna,

we have

Lenn—loin=stone,
Parenna=spear,

therefore the literal translation is

Stone—spear,

or, as we would say, spear stone. Now, can we identify any of the rocks with this "spear stone"? The answer is, Yes, and the identification is as easy as it is plain. It is the basalt that is meant by the word spear stone. The fine columns of basalt—for instance at Cape Raoul—make it perfectly intelligible why the Aborigines should call this rock spear stone. There is hardly anything

more suggestive of a bundle of spears than these regular thin columns of rock placed side by side.

The lenn-parenna is the basalt, there cannot be the slightest doubt, but I think it also includes the diabas. Though not quite as regularly, diabas also breaks in columnar pieces; for instance the organ pipes (1) on Mount Wellington, and it is therefore more than probable that this rock was also called "spear stone." In fact, it is very probable that the pieces of columnar diabas found on the camping grounds, and used as choppers, were designated lenn-parenna in distinction of the real tronatta.

The last word, noan-yale, unquestionably means "white stone." I have above pointed out that yale=gale=male means white, and as noan=loan=loin=stone, the whole word must mean a "white stone." Now, this is a word used by the Western and North-Western tribes, and the question arises which kind of rock could they have designated as "white stone"? There can be not the slightest doubt that this rock is represented by the archaean schists. Archaean schists of a white colour form the most conspicuous rock in Western and North-Western Tasmania, and there is, therefore, every probability that the "noan-yale" is represented by this rock.

In this paper the names of about 16 substances belonging to the mineral kingdom have been examined, and we see that we can classify them under three headings, viz.—

(a) Minerals proper, including substances derived from the roasting of a mineral and the burning of wood;

(b) Rocks;

(c) Substances resulting from the disintegration or weathering of rocks.

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(1) The designation "organ pipes" for this occurrence of columnar diabas is a curious modern parallel to the "spear stone" of the Aborigines. The Tasmanian compared the rock with a bundle of spears, the modern mind with a row of pipes as usually exhibited in an organ. Supposing a superior being suddenly arrived at Hobart, and, pointing to Mount Wellington in order to obtain the name of the rock forming the precipice, received the rather startling answer—organ pipes. I leave it to the reader to work out the logical conclusion for himself.

quartz (crystal), cornelian and pipeclay, and salt. In several instances, viz., salt, pipeclay, and cornelian, it could be proved that the words used had no special meaning appertaining to these substances, but that it was really the transcription of other words, and the same probably applies to the remaining words.

On the whole, the list contains the names of 16 substances, only 7, or perhaps 9, of which can be considered to have played an important role in the life of the Aborigines. These are arranged according to importance:—

1. Hornstone (incl. porcellanite, breccia, and other siliceous minerals).

   Tro-na (mora tro-na), meaning unknown.

2. Red ochre.

   Ba-la-wine, lit. blood.

3. Charcoal (powdered).

   Loa-ra, lit. black.

4. Iron ore (limonite or haematite).

   La-ta, meaning unknown.

5. Basalt, incl. Diabas.

   Lenn-parenna, lit. spear stone.

6. Freestone, i.e. sandstone.

   Po-ta-mali, lit. white po-ta, meaning unknown.

7. Archaean schist.

   Noan-yale, lit. white stone.

To these we may add

8. Clay, incl. pipeclay and any kind of argillaceous soil.

   Man-na-na } meaning unknown
Pen-ga-na-(mali) }

9. Sand.

   Mun-ga-ra-(mena), meaning unknown.

The remaining substances, viz.,

Coal (mineral coal)
Yellow ochre
Quartz (?)
Cornelian (?)
Crystal of unknown kind (quartz)
Salt
Topaz

were not of the slightest use to the Aborigines, except that cornelian, quartz, and the crystal of unknown kind, if found in large pieces, could be used for the manufacture of a tronatta. In fact, we find the quartz pebble distinctly called trautta. The mineral coal was probably designated by the same name as charcoal, the words for yellow ochre and topaz are apocryphic, and there was no proper word for salt at all.

I may add that only the three of these substances, or if we consider the "red ochre" as an altered iron ore, only two, were of any importance in the economic life of the Tasmanians. The hornstone for their stone implements, the red ochre (altered iron ore) for ornamental purposes; for the latter charcoal was also sometimes used.

The remaining five substances were noticed and distinguished, but they did not enter into the routine of daily life, except perhaps when it was necessary to describe a certain tract of country.

Now, if it is advisable to transfer the results of this paper on the language of the archaeolithic man in Europe, we may conclude that he had a different word for

Flint (meaning the substance from which the implements were made)
Red ochre
Charcoal,

and that in all probability he distinguished the most conspicuous rocks of the European landscape—sandstone, limestone, and shale—by different names. As columnar basalt is very common in those localities frequented by archaeolithic man, it is probable that he also

distinguished it under a special name. Sand and clay were probably also distinguished, but this may have limited the vocabulary of archaeolithic man in Europe as far as minerals or rocks are concerned.

If we consider that the primitive language of the Tasmanians knew only three words for mineral substances, two of which, charcoal and red ochre, cannot strictly be considered as such, because they were artificially produced by means of fire; and as it appears very probable that the archaoelithic man of Europe knew of no more, we must wonder when the invention of those words took place which were used to designate the different substances that were already in use during the neolithic stage. If we further consider that in the Tasmanian language the word for "red ochre" means literally "blood," and that for charcoal "black," the first word the human language ever used to designate a mineral was the word for "flint," whatever that may have been, in Europe. Can anything better illustrate the enormous progress of the human race since archaeolithic times than a comparison of the single word for flint with thousands of names by which modern science distinguishes the minerals and rocks found on our earth?

NOTE ON BRACHYCOME MELANOCARPA, SONDER.

By L. Rodway.

(Read 13th September, 1909.)

I take this opportunity of placing on record the occurrence of Brachycome melanocarpa, Sonder et F. von Mueller as a native of Tasmania. It has as yet only been gathered on the eastern slope of Mount Wellington, in a damp locality at about 3,000 feet altitude, but probably occurs elsewhere, only its general resemblance to B. scapiformis, D.C., has caused it to be overlooked. It has hitherto been recorded from South Australia, Victoria, New South Wales, and Queensland.

A tufted perennial, sending up annual flowering scapes of usually four to ten inches in height, as in B. scapiformis, it differs in being more extensively hirsute; the leaf has a long attenuated base or petiole, an obcuneate apex with usually seven bold dentures; the scape is coarser, with more leafy bracts, or commonly bears a gradually reduced series of foliage leaves, but these characters are not quite constant for either species. The involucral bracts are shorter, blunter, and rather more scarious, and the ray florets are shorter. But the typical character is found in the achene. In B. scapiformis this organ is flat, smooth, with acute or winged edges; while in B. melanocarpa it is narrowly obovate, slightly compressed with very obtuse edges, usually tuberculate, viscid, and black. The pappus is formed of many small radiating flat bristles.

This plant is an interesting addition to our flora.

CONTRIBUTION TO THE GEOLOGY OF TASMANIA.

SYSTEMATIC GEOLOGY

THE PRE-CAMBRIAN.

(PLATES VII., VIII.)

By L. Keith Ward, B.A., B.E.
(Assistant Government Geologist.)

(Read 13th September, 1909.)

SUMMARY OF CONTENTS:

I.—INTRODUCTION.

It may not be altogether inappropriate, in contributing a paper on the systematic Geology of Tasmania, to commence at the bottom of the geological column.

In the following pages the writer has the honour to present some portion of the information now available concerning that great series of rocks which constitutes the base of the geological record in Tasmania.

There are several questions connected with these rocks and their relations to the succeeding sediments which cannot but be, in the present state of our knowledge, debatable. Yet it may now be confidently asserted that these rocks are truly Pre-Cambrian in age; and this paper is largely concerned with the nature of the evidence upon which this assertion is made. Hitherto there has been a certain lack of definite information available, and the accurate classification of the series has been, in consequence, impossible of achievement.

However, within the last year the work of the Geological Survey staff has taken Mr. W. H. Twelvetrees and the writer into areas in which these fundamental rocks are well developed, and in which some details of their relationships to other members of the geological record are displayed. The geological exploration of the Great Western Railway route has provided material for an almost continuous section across Tasmania from Gormanston to Tyenna; and during the progress of this work a fund of matter has accumulated which is of inestimable value in the correlation of the strata encountered. This information is here presented in so far as it concerns the Pre-Cambrian rocks; and in the light of these recent discoveries some account is given of the deductions which may be drawn with regard to the origin, growth, and decay of the Pre-Cambrian rocks of Tasmania.

II.—PREVIOUS LITERATURE.

The rocks which are here treated of have been referred to in the earlier literature which deals with the Geology of Tasmania as "Pre-Cambrian" or "Archaean"; but the reasons for which this provisional classification has been adopted have been admitted to be insufficient.

Mr. R. M. Johnston has clearly stated (1) the lack of the necessary evidence required before the "quartzites and metamorphic rocks" of his Geological Table (2) could be definitely referred to this position in the column.

More recently, in a paper read before the Australasian Association for the Advancement of Science (3), Mr. W. H. Twelvetrees gave a brief account of "Probable Pre-Cambrian Strata in Tasmania." In this paper Mr. Twelvetrees has stated that the several occurrences of quartzites, mica schists, and hornblendic schists are to be referred to the Pre-Cambrian mainly on the grounds that they are lithologically dissimilar from any members of the Cambrian, Ordovician, or Silurian systems which are capable of more rigid classification.

Since this paper was written the country between Tyenna and Gormanston has been geologically explored, and the uncertainties and doubts have given place to confident assertions based upon the newly-acquired information. The increase of knowledge, also, with regard to the stratigraphical position of the early Palaeozoic sediments of Tasmania, and the recent correlation of these strata in different parts of the island have assisted to no small degree in placing the classification of the Pre-Cambrian on a firm basis.

The departmental literature which deals with the several districts in which these rocks are developed is mentioned below, when reference is made to these areas.

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(1) R. M. Johnston, Geology of Tasmania, 1888, p. 17.

(2) Ibidem, p. 15.

(3) Proceedings A.A.A.S., Adelaide, 1907, p. 466.

III.—THE STRATIGRAPHICAL SUCCESSION IN TASMANIA.

It is necessary to consider briefly the succession of the lower Palaeozoic strata and the relations of these to the rocks here described, so that the grounds for the classification of the latter as Pre-Cambrian may be properly appreciated.

The recognised base of the Ordovician system is the "Gordon River Limestone." With this limestone are associated sandstones and slates (1) which may belong to the same system.

This fossiliferous limestone at Railton and at the Humboldt Divide lies directly upon the fossiliferous Upper Cambrian beds. It is a persistent geological horizon, and therefore of great stratigraphical importance.

The strata, to which an age greater than that of the Gordon River limestone may be ascribed, whether on palaeontological or on stratigraphical grounds, are these:—

1. The Dundas slate series—with the associated intrusive and effusive porphyritic igneous rocks. These rocks may be equivalent with slates and sandstones at the Needles, and near Mounts Mueller and Wedge.
2. The Caroline Creek beds, and their fossiliferous equivalents discovered by Mr. T. Stephens on the Humboldt Divide in the Florentine Valley.
3. The "tubicolar" sandstone (commonly known as the "pipestem" sandstone); and the "discoidal" sandstone overlying it.
4. The Denison Range conglomerates and quartzites, together with the similar rocks constituting the West Coast Range conglomerate series. The pebbly sandstone and conglomerate of Railton also probably belong to the same horizon.
5. The sandstones, quartzites, slates, grits, and conglomerates of Cabbage Tree Hill, Beaconsfield.

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(1) See Section III.

A short explanation appears necessary in order that the character of the evidence, upon which the age of these five groups has been stated to be, in all probability, Cambrian, may be clearly stated.

1. The Dundas slate series consists of clay slates, sandstones, conglomerates, and breccias, with which are associated a characteristic series of massive and schistose igneous rocks. They extend from the North Coast between Penguin and Ulverstone to Birch's Inlet on Macquarie Harbour, and probably still further to the southward.

The rocks of this series are judged to be of greater antiquity than the Gordon River limestone on stratigraphical evidence (1).

2. The Caroline Creek beds consist of yellow sandstones, which are fossiliferous in both localities where they outcrop, and have been definitely referred to the Upper Cambrian upon the evidence of the organic remains preserved in them.

3. The "tubicolar" sandstone forms a well-marked horizon, which has been recognised at Mount Zeehan, Middlesex, Mount Claude, the Five-mile Rise near Lorinna, and on the Loddon Plains to the eastward of the Frenchman's Cap.

To this horizon has hitherto been assigned a much higher position in the geological column by other authors. The writer considers that it is of Cambrian age for the reasons here briefly stated:—

The peculiar tubular impressions have been recognised in the West Coast Range conglomerate on the Mount Lyell peaks.

The tubicolar sandstone proper overlies the West Coast Range conglomerate conformably at Mount Zeehan, and the relationship of the two formations is shown in Mr. Waller's section across Mount Zeehan (2).

Hence, whatever may be the nature of these problematical fossil casts, they are persistent through at least

(1) Geological Survey of Tasmania, Bulletin No. 5, pp. 8-10.

(2) G. A. Waller, "Report on the Zeehan Silver-Lead Mining Field," 1904.

a portion of the West Coast Range conglomerate series and the overlying sandstone. They have not been observed in any other sandstones, and never in actual association with any other fossils. So we may apparently conclude with safety that the tubicolar sandstone is the next succeeding formation to the West Coast Range conglomerate (where the full sequence is represented) and of slightly less antiquity.

Moreover, during the recent exploration of the country in the vicinity of the Frenchman's Cap, the writer found an extensive development of the tubicolar sandstone in the Loddon River Valley. Here it is conformably overlain by another white sandstone of similar grain; and in this latter sandstone are certain peculiar discoidal impressions. The exact nature of these markings is unknown, and Mr. Etheridge, of the Australian Museum, to whom specimens have been referred, has declined to express an opinion concerning them, since no traces of the organic structure remain.

Mr. W. H. Twelvetrees has pointed out that entirely similar, but smaller, discoidal moulds exist in the fossiliferous Upper Cambrian beds of Caroline Creek. In the event that the discoidal markings should prove to possess stratigraphical value, the discoidal sandstone must belong to the Cambrian system.

It should perhaps be here stated that the tubicolar sandstone has formerly been looked upon as of Silurian age, the reason being that at Zeehan and the Five-mile Rise strata bearing Silurian fossils have been found above this sandstone.

A re-examination of the occurrences of the tubicolar sandstone is therefore required, with a view to the discovery of a possible break in the succession. Should such a break be found between the pipestem rock and the superincumbent Silurian, the explanation of the previous classification of the strata will be provided.

4. The Denison Range is built up of a great series of siliceous sediments—crystalline pebbly sandstones, quartzites, and conglomerates. These rocks have been traced without interruption for many miles from the Thumbs across the gorge of the Gordon River, and northwards along the Denison Range.

The writer has observed a small isolated hill of reddish quartzite entirely similar to that of the Denison Range on the western border of the central plateau, at a spot just to the north of the Linda Track, and a mile to the eastward of Mount Arrowsmith.

Moreover, this sedimentary series, which consists of conglomerate, pebbly sandstone, crystalline sandstone, and quartzite, is, apparently, precisely that which is referred to as the West Coast Range conglomerate series. That is to say, the Denison Range is composed of rocks which appear to be identical in all respects with those which contribute so largely to the bulk of Mounts Jukes, Huxley, Owen, Lyell, Sedgwick, Murchison, Farrell, and Zeehan. The lithological resemblance between the rocks from all these places is striking; and the differences between the rocks of this character and all other known sediments in Tasmania are equally well marked.

These rocks have hitherto been considered to be much younger, but there has been no satisfactory proof of age. The West Coast Range conglomerate has been placed at the base of the Silurian system for the reason that it is clearly older than the tubicolar sandstone. The probable Cambrian age of the latter formation has already been indicated here, and if this be admitted a still greater antiquity must be assigned to the West Coast Range conglomerate series.

By far the most important information bearing on this matter which has yet been gathered is that which was obtained early in 1908 by Mr. W. H. Twelvetrees, in his westward traverse of the country between the Valley of Rasselas and the Prince of Wales Range.

The bedrock of the Valley of Rasselas is the Ordovician limestone, with a strike of N. 25deg. W. and a north-easterly dip at an angle of 70deg. This limestone rests unconformably upon the siliceous sediments of the Denison Range (1), which strike N. 30deg. W. and dip (at the Thumbs and Mount Wright) towards the north-east at 50deg.

Since the Gordon River limestone horizon is regarded as the base of the Ordovician in Tasmania, it

(1) See [illegible]

necessarily follows that the great series of quartzites and conglomerates must be of Cambrian (or even possibly of Pre-Cambrian) age.

Confirmatory evidence again is afforded by the apparent relationship of the West Coast Range conglomerate to the Dundas slate series (2).

Moreover, the porphyritic igneous rocks, which are partly contemporaneous with these Dundas slates, have never been seen in the form of pebbles in the West Coast Range conglomerate. Diligent search has been made by the writer in localities where the two rocks are in the closest proximity, and always without finding any rounded pebbles of the porphyries, or the schists derived from them, in the conglomerate. This seems to him to be highly significant, although negative evidence.

Again, certain structural phenomena are more readily explicable by the view that the porphyries have intruded into the conglomerate beds, rather than that subsequent complex faulting has produced the isolation of blocks of the sediment within the igneous boundaries.

At Railton, the pebbly sandstone and conglomerate appears, from its position, to underlie the Caroline Creek fossiliferous sandstone.

The relation of the Caroline Creek beds to the Dundas slates has not yet been determined, so that a complete chain of evidence regarding the exact age of the conglomerates and the slates has not yet been obtained.

No fossiliferous zone which may serve as a line of demarcation for the base of the Cambrian system has yet been detected.

Our knowledge at the present time is such that it seems advisable to include the Denison Range and West Coast Range conglomerates within the Cambrian system, of which they would therefore seem to form the base.

5. In the vicinity of Beaconsfield a series of sandstones, quartzites, slates, grits, and conglomerates are found to dip under the Ordovician limestone, which lies

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(2) See Section IV.

to the eastward. But the junction of the two systems is rendered complex by faulting (1).

These infra-Ordovician sediments cannot yet be satisfactorily correlated with any of the other developments of Cambrian rocks in Tasmania.

The character and succession of these beds, albeit questions of great interest, cannot here be more fully discussed. We are concerned rather with the relationship of these Cambrian rock groups to the foundations upon which they rest.

In this matter also the most satisfactory evidence has been gathered by Mr. W. H. Twelvetrees near the northern extremity of the Denison Range.

Passing westwards, Mr. Twelvetrees has observed that the siliceous sediments, upon which the Ordovician limestone rests unconformably, themselves rest unconformably upon the foliated rocks which are here referred to the Pre-Cambrian. The actual junction has been observed on the western side of the Denison Range, in the neighbourhood of the North Star (2).

The writer has observed the similar reddish quartzite on the edge of the central plateau near Mount Arrowsmith, resting unconformably on the quartz-mica schists which are described below.

In the valley of the South Loddon River the tubicolar and discoidal sandstone have been observed resting unconformably upon micaceous schists (3).

At Mount Farrell, the eastern wall of the valley of the Sophia River is constituted of the quartz-mica schists mentioned below. These give place, on the western wall of the valley, to the West Coast Range conglomerate and quartzite which form the ridge of Mount Farrell; and these in turn are followed by the

(1) See Section III.
(2) See Section I.
(3) See Section II.

Dundas slates on the western slopes of the mount (1). Unfortunately the junction of the siliceous sediments which form the backbone of Mount Farrell with the quartzite schists on the other side of the valley of the Sophia River, is hidden by the later sediments. But the sequence displayed by this section is significant.

The relationship between the Cambrian sediments of the Beaconsfield district and the schists of the Asbestos Range is shown diagrammatically in a section (2). The relationship is, in part at least, masked by an intrusion of serpentine and aplite between the rocks of the two systems.

The porphyritic igneous rocks, which have now been observed at Mount Farrell (3), Gunn's Plains (4), and North Dundas (5), to be contemporaneous with certain members of the Dundas slate series are only known as intrusives in the quartz-mica schists.

The rounded pebbles of the West Coast Range conglomerate are composed of fragments of the quartzites and quartz-mica schists described below. All of the more durable varieties of these latter rocks are represented in the conglomerate.

We may, therefore, in summing up the evidence collected, state the following facts:—

(a) Whatever may be the inter-relationship of the several groups here referred to the Cambrian system, there is one feature which they possess in common—viz., where an actual contact has been observed, they are found to occupy a higher stratigraphical position than the schists, now for the first time strictly termed Pre-Cambrian.

(b) The Cambrian formations are separated from the subjacent schists by a strong unconformity wherever contacts have been observed.

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(1) See Section IV. Also Geological Survey of Tasmania, Bulletin No. 3.

(2) See Section III.

(3) Geological Survey of Tasmania, Bulletin No. 3, pp. 17 and 34.

(4) Geological Survey of Tasmania, Bulletin No. 5, p. 9.

(5) Geological Survey of Tasmania, Bulletin No. 6, pp. 17 and 38.

(c) The Cambrian sediments are in common much more free from foliation than normal members of the Pre-Cambrian series.

(d) Igneous rocks which were formed contemporaneously with certain of the Pre-Ordovician rocks appear only as intrusive rocks intersecting the Pre-Cambrian schists.

(e) The Pre-Cambrian rocks have been the source whence the material of certain of the Cambrian formations (lying stratigraphically at the base of this system) has been derived.

The writer would therefore submit that the Pre-Cambrian age of certain rocks, described below, has now been satisfactorily established.

IV.—THE LITHOLOGICAL CHARACTERS OF THE PRE-CAMBRIAN ROCKS.

The bulk of these fundamental schists is, beyond doubt, constituted of metamorphosed sediments of aqueous origin; but there are present also certain component parts of the series to which an igneous origin would be ascribed by the writer. It is proposed to give a brief description of these separately.

(a) Schists of Aqueous Origin.

The evidence upon which the origin of these rocks is affirmed is not equally conclusive in every case. But when any large area, in which these rocks are developed, is examined, the observer cannot but be convinced of the unity of origin of the several varieties which are to be found inextricably interlaminated.

The greatest weight, in determining the origin of the series, must necessarily be placed upon those varieties which afford the least questionable evidence. And the varieties which, more than others, possess this quality are those in which original characteristics of composition and texture have been least masked by molecular readjustment and mechanical deformation. These are the schistose conglomerates

Many slightly different varieties of these exist, and although the origin of most is readily recognisable at once, that of others becomes apparent only after the progress of weathering.

The usual variety of schistose conglomerate is perhaps best seen in the beach exposures between Ulverstone and Penguin—notably at Goat Island. The pebbles are quartzose, and are often greatly elongated. The finer-grained portion of the rock is precisely similar to many of the micaceous schists which do not contain pebbles.

A more altered, but still more easily recognisable conglomerate occurs at the eastern end of Calder's Pass and on the low country between that pass and the Jane River. In this variety the jasperoid pebbles are excessively flattened, and often sheared, by the crushing forces.

Not far from the locality where this variety was seen, and close to the northern extremity of the Prince of Wales Range, the writer observed a quartzitic schist, which seems to be a crushed quartzose conglomerate. The rock when freshly broken appears to be a quartzitic schist of the usual type described below, but weathered surfaces show smooth elongated protuberances standing in relief above the general surface of the rock. The character of these weathered surfaces is thus entirely similar to that of the schistose conglomerate of Goat Island, near Ulverstone. And the rock would appear to be a true conglomerate, the nature of which is not at first sight obvious, on account of the similarity of composition between the original pebbles and interstitial sand, and the consequent like alteration of coarser and finer ingredients by secondary processes.

In several other places within the observed limits of the Pre-Cambrian the writer has observed rocks which he regards as conglomerates, the original characters of which are masked by an intimate impregnation with silica. They now appear as dense quartzites, showing slight variations of colour and texture in the several portions of the same rock mass. These portions, which thus differ inter se, exhibit semi-rounded to subangular outlines.

With these crushed and altered sediments of coarser grain are associated a great variety of schists and

quartzites, in such a way that the whole group must be considered together as a series of sediments formed by aqueous agencies. The interstratification of the schistose conglomerates and the genetically related argillaceous, micaceous, and quartzitic schists is perhaps most clearly displayed on the northern coast, near Ulverstone. There the beds are tilted, so that they stand on edge, and the succession of the several varieties is seen to be just such as is usually found where sediments have been deposited under varying conditions.

The variety displayed by these schists of finer grain is remarkable. The nature and proportions of the constituent minerals, and the degree of schistosity acquired, all vary from point to point.

Most commonly the schists are constituted of an aggregate of quartz and a sericitic mica. These quartz-mica schists pass on the one hand, by insensible gradations, into pure quartzites, and on the other into mica schists. The intermediate varieties are characteristic of the series as a whole.

The quartzite-schists are at times remarkable for the perfection of the cleavage which they display, the development of the mica being such that thin flakes, no more than a millimetre in thickness, can be successively detached. In some cases this fissile schist exhibits a minute but elaborate puckering, which shows admirably the nature of the stresses to which the rock has been subjected. This latter variety is especially noticeable on the Linda Track, between the Collingwood and Franklin Rivers.

The argillaceous schists are widely distributed through the regions occupied by these Pre-Cambrian rocks, and are especially abundant in the neighbourhood of Cox's Bight. They show clearly, in some cases, the original planes of stratification, and are little different in any particulars from unaltered shales. In other cases these argillaceous varieties have had a slaty cleavage impressed upon them, and are converted into true slates.

They merge into schists, in which mica predominates. These possess a colour which usually varies between pale green and yellowish grey, and possess a greasy feel. The quartz is commonly restricted to lenticles and wavy bands. Other varieties are reddish from

the development of haematite. In other varieties, again, the colour is dark grey, from the presence of some colouring matter the nature of which is obscure. Some of the dark varieties are clearly graphitic, but are not commonly seen.

In the upper part of the Collingwood River valley some garnetiferous varieties have been found by the writer. And near the latter, as elsewhere throughout the neighbouring district, there are present some embryonic minerals in the schist which, from their presence, exhibits knots and complementary depressions on the cleavage surfaces.

The quartzites found among these markedly schistose rocks are frequently perfectly free from all signs of foliation. They are almost always pure white in colour and extremely dense in texture.

The freedom from foliation in these rocks is probably largely due to an original purity of composition. The absence of the foliation, nevertheless, appears remarkable when the quartzitic beds, perfectly free from visible schistosity, are seen interlaminated with the foliated mica schists. The microscopical characters of such quartzites have not yet been studied.

It may be that the quartzitic bands have moved as a whole before the crushing forces. However, it appears to the writer more probable that the foliated appearance of the micaceous schists is largely caused by recrystallisation under pressure rather than by actual displacement of adjacent particles. Over and above this foliation there has been induced also, in very many cases, elaborate crumpling; but a foliated texture may result where crumpling has not occurred. It will be seen later that in some places the quartzites are folded and fractured.

Summing up, the several schists of which mention has been made must undoubtedly represent a great series of sediments—psephites, psammites, and pelites —which have suffered dynamical metamorphism.

This lithological division of the Pre-Cambrian comprises by far the larger portion of the rocks to which reference is made in this paper.

(b) Schists of Igneous Origin.

Associated with these quartzites, quartz-mica schists, argillaceous, and micaceous schists are certain amphibolites, to which the writer would ascribe an igneous origin.

The largest development of these amphibolites is that which has been observed in the Rocky River district by Mr. W. H. Twelvetrees.

Less extensive occurrences have been recorded from Hamilton-on-Forth and the Collingwood River Valley. In both of these latter cases there is a notable development of garnet and zoisite.

The detailed description of these interesting rock types is postponed, pending a more minute microscopical examination.

The only other rocks of igneous origin which may possibly belong to the Pre-Cambrian are certain pegmatites, which have been found in the Collingwood River Valley and in the neighbourhood of Calder's Pass. There is, however, a very strong probability that these have been introduced into the schist series in Devonian time.

V.—THE STRUCTURAL FEATURES OF THE PRE-CAMBRIAN.

Few constant features of structure have been recorded from the several exposures of these rocks which have been examined. The distribution is so wide that, in the absence of complete and systematic surveying, this is not a matter for surprise. And although much is to be gained by the careful examination of the structural characters of the group as a whole, little achievement has so far been possible in these matters.

The recognition of any definite horizons in the system is naturally a matter of importance for purposes of stratigraphical delimitation.

In the case of the highly schistose and crumpled members of the system, it is almost impossible to arrive at any satisfactory conclusion regarding the total thickness of the beds or their original order of stratification.

With regard to the development of these rocks on the South Coast of Tasmania, Mr. W. H. Twelvetrees has estimated the thickness at 13,000 feet as a minimum (1). This calculation is based on the assumption that no large anticlinal folds exist, and that the average dip is not less than 10 degrees.

During the recent western exploration work in the neighbourhood of the Frenchman's Cap, the writer was enabled to make some observations which should here be recorded.

The outstanding feature of the Pre-Cambrian in that region is the existence of a considerable thickness of bedded quartzite schist lying in an approximately horizontal position upon the top of the quartz schist, quartz-mica schists, and micaceous or argillaceous schists.

Viewing this thick layer of quartzite schist from the tops of the ranges, one gains the conviction that it is a single horizon, resulting from the alteration of a once continuous horizon of sandstone. This horizon apparently extended from the Raglan Range southwards to the Frenchman's Cap and the Surveyor's Range, and eastwards to a mountain (called by the writer Algonkian Mountain) at the northern extremity of the Prince of Wales Range, and slightly to the westward of the axis of that range. Whether the white serrate peaks of the Prince of Wales Range are on this horizon the writer cannot say.

Only the highest portions of the ranges mentioned are composed of this quartzite schist, which in most cases stands up boldly with precipitous walls above the slopes carved in the softer schists.

From a short distance the quartzite schist appears to be a bedded sandstone, since the progress of weathering accentuates the original bedding planes. But on closer examination a slight schistosity is noticeable throughout the rock.

This horizon, as a whole, is not free from foliation, and the best view of the folding is obtained from the

(1) Proceedings A.A.A.S., Adelaide, 1907, "Probable Pre-Cambrian Strata in Tasmania," p. 470.

highest peak of the Surveyor's Range. Looking thence towards the north, the eastern portion of the summit of the Frenchman's Cap is seen to be folded into gentle anticlines and synclines, and to have been fractured. The other portions of the horizon appear to have remained unaffected, and to be nearly horizontal. The massive layers so plainly visible on the north-western and western faces of Algonkian Mountain appear quite undisturbed by folding forces, and dip at a low angle towards the south-west.

Between these remaining summits of the ranges the quartzite schist stratum has been removed by denudations, and the subjacent schists are exposed.

The horizon of quartzite schist rests unconformably upon the quartz-schist and mica-schists, which show a much more intense folation. This unconformity is clearly seen on travelling along the top of the Surveyor's Range. The higher peaks of this range (which lies between the Jane and Acheron Rivers) are of the more massive variety, and the abrupt change into the highly contorted schists of the main mass of the range is most noticeable.

The existence of plainly horizontal layers of the rock overlying the contorted schists is a strong argument for not only the presence of a marked unconformity, but also for a long period of erosion between the time of foliation of the lower schists and that of the deposition of the upper quartzose sediments, which have since been rendered slightly schistose.

Confirmatory evidence must be obtained throughout this region before these views can be fully accepted; but the writer is strongly of the opinion that there is a distinct unconformity present in the district, and that two distinct periods of sedimentation are represented, and that a protracted period of erosion has intervened between the deposition of the lower and upper members. The greater degree of contortion displayed by the lower series may be accounted for by the fact that these rocks have suffered plication before the upper horizon was formed.

If it be granted that there are two such distinct series among the Pre-Cambrian sediments in Tasmania,

an interesting comparison may be drawn between the Tasmanian occurrences and those of Canada. This matter is discussed in a later portion of this paper.

In estimating the thickness of the sediments represented in the region surrounding the Frenchman's Cap, it is evident that the structural features, referred to here, must be duly considered. Enough detailed information has not yet been acquired to give even an approximate idea of the true thickness of the upper and lower series of which mention has been made.

The writer claims that there is a marked unconformity, above which several hundred feet of sediments exist, and below which a very much greater thickness is represented by the more schistose members of the Pre-Cambrian. About 2,000 feet of the latter schists are visible in the immediate neighbourhood of the Frenchman's Cap, if we calculate only the vertical distance between the lower limit of the upper quartzite on the top of the range and the bottom of the river gorges carved in the foliated schists. But it is more than probable that the vertical thickness of the schistose strata in this region differs from that of the original beds. No account has been taken of the effects of compression and foliation, nor can these be quantitatively estimated in the present state of our knowledge.

The recognition of two distinct horizons in the Pre-Cambrian necessitates a very careful treatment of the structural features of strike and dip, unless it is perfectly plain which horizon is under examination.

In the region traversed by the Franklin River and its tributaries the upper horizon is, on the whole, as indicated above, nearly horizontal, but the variations in dip and strike of the lower members are very marked.

A general absence of regularity of structure is noticeable in every district, and the axes of the main foldings do not appear to have extended for long distances.

Nor have the folds exerted any appreciable effect upon the topography. No traces of ancient fold ranges have remained in those areas where these rocks have been examined by the writer. And the outlines of the present mountain ranges are noticeably independent of the rock structure.

Where the Pre-Cambrian rocks are penetrated by igneous intrusions, the latter do not, in general, appear to acquire forms which are moulded by the structure of the schists. The only exception which may be cited is that of the small dykes or veins of pegmatite in the valley of the Collingwood River.

VI.—THE GENESIS, HISTORY, AND PRESENT PHYSIOGRAPHICAL FEATURES OF THE PRE-CAMBRIAN IN TASMANIA.

Having come to the conclusion that the great bulk of these Pre-Cambrian rocks represent aqueous sediments, more or less altered subsequently to their deposition, but accumulated under conditions similar to those existing on continental borders at the present time, we naturally look for the sources of the fragmental material which built up these ancient beds of conglomerate, sandstone, and shale.

The composition of these beds gives some idea of the nature of the rocks whence the fragments were derived. For the vast accumulation of clay and silica must have resulted from the disintegration of quartz and aluminous silicates. By the action of the many processes involved in the weathering of such rocks, the transport of the fragmental matter to the sea, the sorting distribution and final deposition of this material on the sea floor, these Pre-Cambrian sedimentary beds were built up.

But there have not yet been seen in situ in Tasmania any rocks of greater age than these sediments. Detached boulders (1) have been found which present analogies, in both composition and structure, with the lower Pre-Cambrian rocks of other parts of the world; but these boulders have not yet been traced to their source.

The quartz and aluminous silicates must have been derived from some still older primary rocks, probably now hidden beneath the sea.

(1) One of these boulders, of a coarse gneiss, was found by Mr. G. A. Waller at the 29-mile peg on Innes' Track to Barn Bluff. Garnetiferous gneiss boulders also occur in the permo-carboniferous glacial beds which outcrop on the North Coast at Wynyard.

No definite clue being provided in Tasmania, we look to the Australian continent for signs of the existence of Archaean rocks, which may be remnants of the Pre-Cambrian land mass that was the source of these sediments.

Brief mention is made below of the Australian occurrences of Pre-Cambrian rocks. Of these the rocks which bear most directly upon the question now being discussed are the gneisses, gneissose granites, and hornblendic schists of Western Australia; and the gneisses of South Australia. These bear the strongest lithological resemblance to the Archaean rocks of other countries.

The Pre-Cambrian schists of Tasmania may well have derived their material from these ancient crystalline gneisses, schists, and granites, and possibly from the more proximate southward extensions of the masses referred to above now covered by the Southern Ocean.

This question of genesis demands a much greater elaboration than can here be effected. It is sufficient to state that these quartzites, argillaceous, and micaceous schists and schistose conglomerates constitute the terrigenous deposits formed on the borders of the Pre-Cambrian Australis—a land mass known from its exposed remnants to be competent to provide such material.

After the prolonged period of sedimentation which is represented by the lower schists and conglomerates, a period marked by intense dynamic metamorphism must have ensued. The subsequent erosion of these older schists levelled the floor upon which the upper sediments were deposited.

The schistosity observed in these upper members of the Pre-Cambrian may have been induced before the period of deposition of the Cambrian sediments. For there is a notable difference in appearance between the appearance of the upper Pre-Cambrian quartzitic schist and that of any sedimentary rock of later date.

A notable unconformity exists between the Cambrian and the Pre-Cambrian sediments at the northern end of the Denison Range. There is, however, not yet sufficient evidence available upon which to base an account of the physiography of Western Tasmania at the time of the Cambrian sedimentation.

Orogenic movements, which have tilted the Cambrian rocks till they stand vertically in some places, must have affected the subjacent Pre-Cambrian rocks as well.

After the close of the Cambrian period no schistosity of any moment appears to have been developed in any of the Tasmanian rocks.

The Ordovician sediments indicate a deep submergence of Western Tasmania beneath the ocean, and traces of the marine limestones still occupy the beds of some of the western rivers. These are not deposited conformably upon the sediments of Cambrian age, and their position in deep troughs carved in the schists argues for a mature erosion of the areas covered by the Pre-Cambrian rocks before submergence in Ordovician time.

Since the exposed peaks and ridges of Pre-Cambrian rocks appear to attain altitudes which are approximately the same, the idea suggests itself that a peneplain may have been developed in late Pre-Cambrian or Cambrian time. This peneplain may have been deeply dissected before the Ordovician period. However, this matter demands much more detailed investigation over the whole of the Pre-Cambrian terrain.

The area lying between the Raglan Range and the Prince of Wales Range, examined by the writer, appears to have regained many of the fundamental outlines which it possessed at the beginning of the Ordovician period. These outlines were masked by the deposition of Ordovician and Silurian sediments, and then, after an interval, of those of Permo-Carboniferous and Mesozoic age.

The only igneous invasion which was sufficiently widespread to deserve mention here is that of the upper Mesozoic diabase. This diabase still remains in the form of outliers capping the mountains built of Cambrian and Pre-Cambrian rocks. Its distribution argues a much wider extent than is now apparent, and its existence postulates a cover of sedimentary rocks, since removed by subaerial denudation.

Since the close of the Mesozoic era progressive degradation of the whole of Western Tasmania has continued almost without interruption; and in the final stages of this long cycle of erosion the physiography of

early Palaezoic time has exerted a powerful influence in the moulding of the land forms of to-day.

The overlying sediments have been worn down, and great gorges have been carved through the diabase down on to the Pre-Cambrian bedrock.

On the flanks of these valleys there remain in some places the remnants of former sedimentary basins. For instance, on the north-western face of Mount Arrowsmith lies the fragment of a Silurian sandstone formation dipping to the westward at a low angle. The same formation has been to a greater degree preserved in the area lying to the northward of the Raglan Range. And even here the Nelson River is now steadily removing the softer sandstone, while the relatively harder quartz schist of the Raglan Range is forcing the river channel ever to the northward.

Still more significant of the surviving control exerted by the lower Palaeozoic physiography over present land forms is the distribution of the limestone in the valleys of the western rivers—especially of the Gordon River and its tributaries. Recent exploratory work has proved a remarkable restriction of limestone (all the exposures of which appear to be of Ordovician age) to the bottom of some of these valleys. In some cases the limestone is only visible actually in the beds of the rivers which traverse these valleys. These latter remarks apply to the Jane and Denison River valleys.

In the case of the Surprise River, which occupies the gorge between Mount King William 1st and the Loddon Range, the limestone has been cut through by the corrosive action of the river, and is now situated a few feet above river level.

The manner in which these ancient sediments conform to the present physiographical outlines is at least suggestive of the theory here advanced.

But it must be remembered that an explanation of the phenomena exhibited by such a restricted area cannot be applied beyond the limits of this area. The Ordovician limestone of Western Tasmania is not always found in the depths of the valleys, and occurrences which might seem to contradict the hypothesis here put forward are probably to be easily explained in different ways. The corrosive action of the different rivers may have outstripped erosion and left the lime-

stone on the higher country; or, again, local displacements of the crusts may give rise to modes of occurrence which may seem at variance with this theory. Yet, in the case of the occurrences of limestone in the valleys of the Jane and Denison Rivers, at least, we seem to be forced to the conclusion here stated. It will be interesting to ascertain the limits over which the theory may appear applicable as the geological survey of the island proceeds.

While we may, in the opinion of the writer, safely accept the theory for the restricted area, it must be borne in mind that changes are continually being effected. The cycle of erosion now operative has certainly modified the former features, but the main scheme of existing topography seems to correspond closely with that which obtained at the close of the Cambrian period.

The physiography of the central western area has been determined by erosion rather than by structure, by epigene rather than by hypogene agencies.

This account of the physiographical history of the Pre-Cambrian has been written mainly from the evidence afforded by the central western area, since the writer is most familiar with that area. Modifications may be necessary with an increase of information, but it is contended that this historical outline is substantially correct.

VII.—THE DISTRIBUTION OF THE PRE-CAMBRIAN IN TASMANIA.

A map of Tasmania showing the several areas occupied by Pre-Cambrian rocks has been prepared to accompany this paper. On this map the several areas are numbered, and reference is here made to the different districts in the order in which they have been numbered on the map.

I. The Asbestos Range area, lying to the west of Beaconsfield, and extending southwards from the coast-line at Badger Head, comprises a series of micaceous schists, slates, and grits, with a strike of N. 10deg. W. to N. 20deg. W. (1). These rocks are bounded on the east by serpentine and other igneous rocks in the vicinity of Beaconsfield (2). On the coast-line recent sands and drift overlap the Pre-Cambrian on both sides of the range (3).

The southward extension of this belt of schistose has not yet been fully mapped.

II. At Hamilton-on-Forth there is an exposure of the Pre- Cambrian bedrock in the gorge of the Forth River. The rocks represented are quartzites, quartz-mica, mica ceous and graphitic schists, and with these a belt of garnetiferous-zoisite-amphibolite.

The strike of the schistose sediments varies from N. 10deg. W. to N. 30deg. W., and they dip to the south-west.

This exposure is covered, save in the river gorge, by Tertiary basalt; and on being followed southwards is found to disappear below the Cambrian formations (4).

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(1) See W. H. Twelvetrees' "Report on Coal near George Town, and Slate near Badger Head," 1904.

(2) See W. H. Twelvetrees' "Report on the Mineral Resources of the districts of Beaconsfield and Salisbury," 1903.

(3) See T. Stephens' "Notes on the Geology of the North-West Coast of Tasmania from the River Tamar to Circular Head," Proc. Linnaean Soc. of New South Wales, 1908.

(4) See W. H. Twelvetrees' "Report on the North-West Coast Mineral Deposits," 1905.

III. On the northern coast-line, at Ulverstone, a complex series of the schistose sediments and quartzites described above is to be seen (1). These rocks extend eastwards as far as Button's Rivulet, and westwards to the middle of Barkworth's Bay, west of Goat Island.

On both sides the schists are bounded by Tertiary basalt.

At the mouth of the Leven River the strike is, on the average, about N. 10deg. E., while to the west of Goat Island it ranges from N. 12deg. E. to N. 30deg. E. The dip is to the north-west.

IV. Between Jacob's Boat Harbour and the Detention River, on the northern coast, there are found quartzites and quartz-schists (2). Rocky Cape is built up of massive bedded quartzites, which extend a mile and a half southwards beyond the main road.

At Rocky Cape port the bedded quartzites strike N. of E., and the contorted quartz-schists which succeed them on the west strike N. 80deg. E. At Jacob's Boat Harbour the strike is N.W., and the dip towards the N.E.

The southern extension of these rocks is covered by Tertiary basalt.

V. A narrow belt of Pre-Cambrian rocks has been observed at the junction of the Whyte and Rocky Rivers, crossing the Waratah-Corinna road (3). This road, between points distant from Waratah 19 miles and 31½ miles, traverses the belt referred to diagonally. However, the observed width of these rocks is only about four miles.

The Rocky River schists are amphibolites, sometimes compact and granular, sometimes distinctly schistose, flanked on either side by schistose sediments.

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(1) Geological Survey of Tasmania, Bulletin No. 5, 1909.

(2) See W. H. Twelvetrees' "Report on the North-West Coast Mineral Deposits," 1905.

(3) See W. H. Twelvetrees' "Report on the Mineral Fields between Waratah and Corinna," 1900.

The Long Plain, on the east of the amphibolite, contains quartzitic, sericitic, and graphitic schists. To the westward the country contains slate and quartz schist, but no detailed geological examination has yet been made.

This zone of schists is known to extend in a north-westerly direction for 10 miles, where it crosses the Savage River.

The strike of these rocks is N. 10deg. W., and the dip to the N.E..

VI. The most northerly of the larger areas covered by the Pre-Cambrian rocks is that which extends from the Mackintosh River on the west to the Forth River on the east, and almost to the Dove River on the north (1).

The western portion of this area is penetrated by the granite of Granite Tor (2) and there is a larger area of Permo-carboniferous sandstone, capped by diabase, overlying it at Barn Bluff. On the south similar rocks to these last-mentioned go to build up the Eldon Range, which separates this area from that which is numbered VIII.

The rocks are chiefly foliated quartz-schists, with micaceous and argillaceous schists as well, the strike of which is a few degrees N. of W. at Barn Bluff.

VII. What is probably a small outlier of the latter area is situated between the head of the King River and the North Eldon River, to the east and south-east of Lake Dora.

VIII. The largest unbroken development is that which extends southwards from the vicinity of the Eldon Range throughout the greater part of the basin of the Franklin River (3). On the north-west it is bounded by the superincumbent Silurian sediments

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(1) See G. A. Waller, "Report on the Mineral Districts of Bell Mount, Dove River, Five-mile Rise, Mount Pelion, and Barn Bluff," 1901.

(2) Geological Survey of Tasmania, Bulletin No. 3.

(3) See "Report of the Department of Lands and Surveys for 1907-1908."

which lie to the north of the Raglan Range. On the north-east it extends to the edge of the Central Plateau, where the upper Mesozoic diabase covers it.

The Raglan Range, the Frenchman's Cap, and Deception Range form the observed western borders of this area. On the eastward the lower slopes of Mount Gell, Mount Arrowsmith, and the western slopes of the Loddon Range form the limits of these schists. A considerable area of Cambrian rocks has been seen to overlie the Pre-Cambrian to the east of the Frenchman's Cap. And Ordovician limestone has been located in the beds of the Denison and Jane Rivers. (It has been found impossible to represent the Jane River limestone on the map, for the reasons that the outcrop is absolutely restricted to the river bed, and the scale of the map will not admit of the representation of such a narrow band.)

The eastern boundary of the Pre-Cambrian lies to the west of the Denison Range, and crosses the Gordon River near the junction of the latter with the Wedge River. Thence it has been observed to run southwards a little to the east of Lake Pedder. Beyond this point it has not been followed, but it is thought to continue to the south coast near the New River.

This southern extension of the Pre-Cambrian embraces the Frankland Range, and probably the country between that range and Port Davey.

All varieties of quartzites, quartzite-schists, micaceous, argillaceous, and graphitic schists are found within the limits of this area. The probable existence of an upper horizon of quartzite-schist has been indicated above.

To the west of the Denison Range the strike is usually north-easterly. South of the Gordon River the strike varies between N. 5deg. and N. 30deg. W.

IX. The most southerly development is that which extends from a point to the westward of New River along the south-western coast beyond Port Davey. This area is pierced by a small intrusion of granite at Cox's Bight (1).

(1) See W. H. Twelvetrees' "Report on Cox's Bight Tin Field," 1906.

The northern and north-western limits have not yet been determined. The area is probably continuous with that which has last been described (VIII.).

There are quartzites interbedded with argillaceous schists at Cox's Bight. These have a strike between N.N.W. and N.W., and dip to the south-west at low angles.

Of Port Davey there is but little known, save that the white quartzites of the port extend northwards along the coast for some distance.

VIII.—NOMENCLATURE AND CORRELATION.

It is impossible to discuss the nomenclature of these rocks without at the same time briefly discussing the relationship which they bear to rocks of like age in extra-Australian areas.

In assigning an age to the strata which have been deposited since the beginning of the Cambrian era, the evidence of the fossils preserved in the rocks is the most important. But with regard to the Pre-Cambrian no such criteria are available.

It is true that there are well-authenticated cases of the existence of organic remains in beds which are stratigraphically lower than those containing the typical lower Cambrian fauna; and it is also true that the diversity of the Cambrian fauna presupposes a Pre-Cambrian fauna. But all organic remains are ill-preserved in the Pre-Cambrian rocks, while in Tasmania no such remains have yet been detected.

On stratigraphical evidence we have come to the conclusion that the Tasmanian rocks here discussed are truly Pre-Cambrian. But the word "Pre-Cambrian" cannot but be regarded as merely a temporary epithet, to be replaced by one which will define the age more exactly when our knowledge of these rocks has become sufficiently advanced to ustify a refinement in classification.

For the word "Pre-Cambrian," used in its literal sense to designate those rocks which are of greater antiquity than the Cambrian, embraces several rock-

groupings now fully recognised in the regions in which they are represented. It has been estimated that these groupings of the Pre-Cambrian are comparable in importance to the systems (Cambrian, Ordovician, Silurian, etc.) into which the Palaeozoic has been divided.

Hence Messrs. T. C. Chamberlin and R. D. Salisbury have in their Geology (1) divided the Pre-Cambrian rocks into two main groups of systems—the Proterozoic and the Archaeozoic—which rank more nearly with the main subdivisions of the upper portion of the Geological Record, viz., Palaeozoic, Mesozoic, and Cainozoic.

By these authors the Proterozoic and Archaeozoic are again divided in the manner indicated in the table of classification which has been prepared to show the various systems of nomenclature.

The Pre-Cambrian succession in North America has been specially studied by a committee appointed by the Geological Surveys of the United States and Canada, and the classification adopted by the members of this committee (2) is given in the accompanying comparative table.

It will be seen that the succession stated by this committee, to be applicable to the North American areas, differs from that of Messrs. Chamberlin and Salisbury. The chief difference lies in the transposition of the two lowest groups. Messrs. Chamberlin and Salisbury agree with other American geologists in placing the Laurentian above the great schist series (which includes the Keewatin), for the reason that in many cases the granites and gneisses of the Laurentian occur as intrusions into the schist series. However, this question has no direct bearing on the Tasmanian developments, and will not be further discussed.

On the whole, therefore, it will be conceded that a definite succession of groups has been established for the North American region.

There are, however, differences of opinion as to how these Pre-Cambrian series may best be included in major groupings.

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(1) Loc. cit., Vol. II., p. 139.

(2) Ibidem, Vol. II., p. 161. Also Journal of Geology, Vol. XIII., No. 2, 1905, pp. 89-104.

There are, according to C. R. Van Hise, two main divisions of the Pre-Cambrian which are to be recognised in all parts of the world where rocks of this age are found (1). This twofold division is based upon the essential differences in the lithological character of the upper and lower members of the Pre-Cambrian.

The term Archaean is now restricted to that portion, of dominantly igneous origin, which constitutes the basal complex. It corresponds to the "Archaeozoic" of Messrs. Chamberlin and Salisbury.

On the other hand, the term "Algonkian" is applied to those rocks the origin of which is, in the main, aqueous (2). Igneous rocks are associated with these, but are subordinate in amount. The term Algonkian corresponds to the "Proterozoic" of Messrs. Chamberlin and Salisbury.

This subdivision of the Pre-Cambrian into these two groups has not, however, met with universal acceptance.

In the light of the more recent researches in the North American region, doubt has arisen in the minds of the Canadian geologists as to the value of lithological character alone as the basis of correlation.

Professor F. D. Adams, in a recent paper (3), suggests the use of epochs of diastrophism in the comparative study of the Pre-Cambrian rocks of North America and Asia, with a view to correlation.

In this paper Professor Adams shows that there are "three major periods in the Pre-Cambrian history of Laurentia, separated by two critical periods of diastrophism" (4). Of these breaks, the lower coincides with that which separates the Algonkian from the Archaean; while the upper break divides the Middle Huronian from the Upper Huronian (Animikean).

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(1) United States Geological Survey, Bulletin No. 86. Also Journal of Geology, Vol. XVII., No. 2, 1909, pp. 97-104, 118-122.

(2) It is interesting to note that the late M. A. de Lapparent brought this upper division into his Palaeozoic group, calling it the Pre-Cambrian system. Below the Palaeozoic group he places the Archaean group. Traité de Géologie, 1906, Vol. II., pp. 723, 752-765.

(3) Journal of Geology, Vol. XVII., No. 2, 1909, pp. 105-118, 122-123.

(4) Loc. cit., p. 115.

The same author has drawn attention to the existence of similar epochs of diastrophism in Asia, and correlates the Asiatic succession with that of North America by a time relation to these diastrophic epochs.

With the question of the North American-Asiatic correlation we are not here concerned; but we are bound to consider most carefully Professor Adams' contention *that the Pre-Cambrian group should be divided into three systems rather than two.* For Professor Adams insists that the upper break—called by Professor Lawson the "eparchaean interval"—is "one of the greatest unconformities in the whole of the Pre-Cambrian succession of Laurentia, and probably quite as important, if not more so, than the break at the close of the Keewatin" (1).

As regards the Tasmanian Pre-Cambrian terrain, any attempt to apply in detail the conclusions arrived at by American geologists is not yet warranted.

While close correlation cannot be attempted, some account should be given of the more general relationships of the Tasmanian occurrences.

We know that the Pre-Cambrian rocks of Tasmania are typically such as would be designated Algonkian by Van Hise. Moreover, the writer holds the opinion that there is, at least in the district surrounding the head of the Jane River, a twofold division of these rocks, and that the two groups are separated by an unconformity. But much detailed field work must yet be done before any sound deductions can be drawn from the existence of this unconformity. Exact correlation with the rocks of distant geological provinces is quite impossible.

Moreover, it must be borne in mind that one unconformity only has yet been observed in the Tasmanian Pre-Cambrian development. In the North American succession three unconformities above the Lower Huronian series (2) are recognised by the members of the classification committee, although there is a want of agreement in the matter of the importance that should be attached to the different unconformities. On this question the special committee expressed no opinion.

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(1) Loc. cit., p. 122.
(2) See comparative table at the end of this paper.

Supposing for the moment that the Tasmanian unconformity should correspond exactly to one of those recognised in the North American region, we do not know which of these it might be, nor whether it is a major or minor one.

Nevertheless, in the future attempts to unravel the Pre-Cambrian history of Tasmania, the observations of North American geologists must be kept constantly in view.

It may be possible to effect some compromise between the schemes of nomenclature proposed by Van Hise and Adams, which are shown side by side in the accompanying table. The use of terms with a "zoic" termination appears to the writer to involve the assumption of a greater knowledge of Pre-Cambrian life than that which we really possess. And, on the other hand, the term Algonkian is rapidly gaining acceptance in countries outside of America. Perhaps the modifications, Analgonkian and Katalgonkian may serve to distinguish the two major groupings of those Pre-Cambrian rocks which post-date the Archaean.

It has been found impossible to correlate the Pre-Cambrian rocks of Tasmania with those of Australia from a lack of familiarity with the extra-Tasmanian developments.

In the latest volume of the Official Year Book of the Commonwealth of Australia (1), condensed summaries are given of the geology of the various States. From a perusal of these it will be seen that rocks of Algonkian type are developed in Victoria, South Australia, Western Australia, and in the Broken Hill area of New South Wales.

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(1) Op. cit., No. 2, 1909, pp. 78-111.

APPENDIX.

NOTES IN EXPLANATION OF THE PLATES.

I. Map of the distribution of the Pre-Cambrian rocks in Tasmania.

The boundaries of the Pre-Cambrian areas are drawn where they have been determined.

Where no boundary line is drawn round the hatched areas it is implied that further investigations may reveal a more extended distribution of these rocks in those directions not limited by observed boundaries.

II. The generalised sections are not drawn to scale. They are intended to represent only the relationships between the several formations represented.

While they are to be regarded as diagrams only, the dips of the various beds are represented as accurately as is possible by the inclination of the lines which serve to indicate, in a general way, the bedding planes.

Section I. represents a length of about five miles.

Section II. represents a length of about one mile.

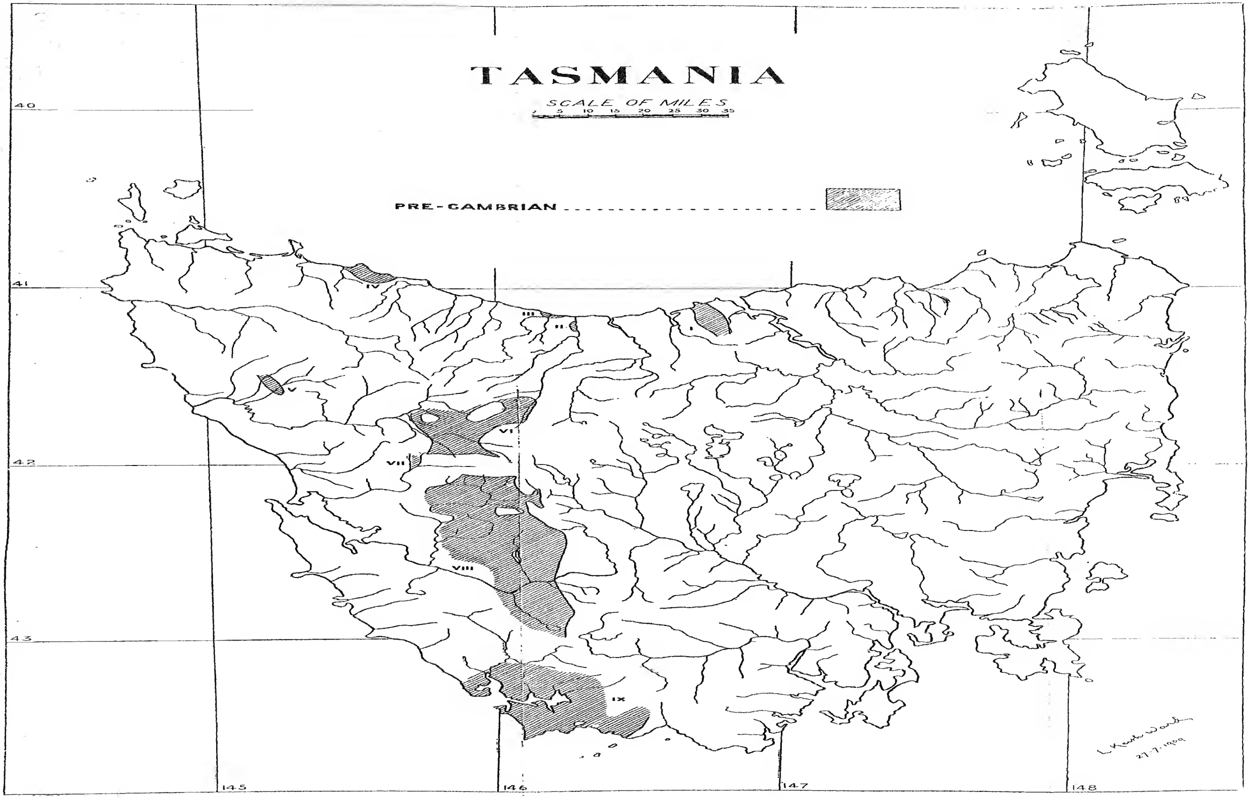
Section III. represents a length of about five miles.

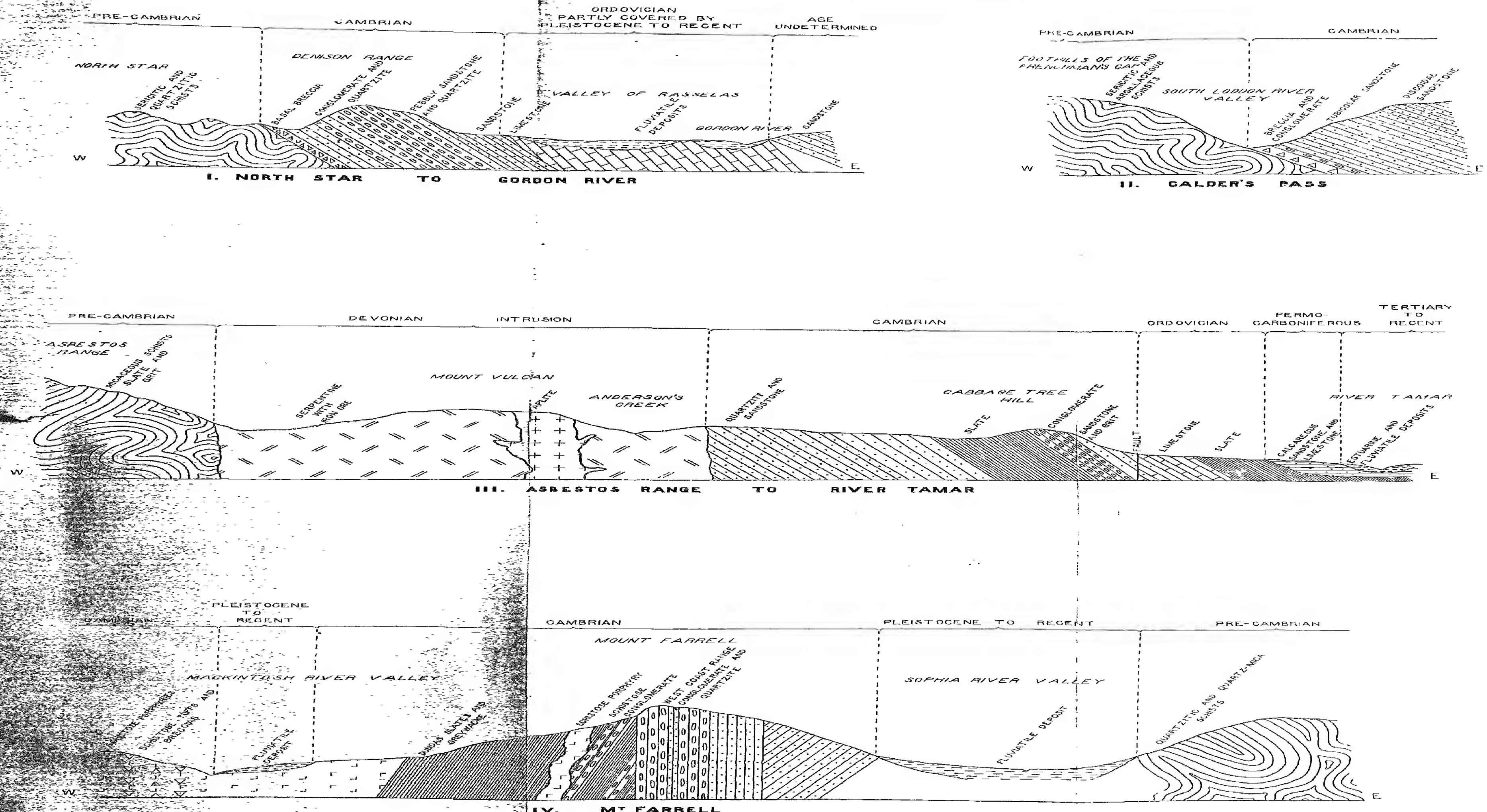
Section IV. represents a length of about four miles.

THE PRE-CAMBRIAN SUCCESSION IN NORTH AMERICA.

Classification Committee of the Geological Surveys of the U.S.A. and Canada.		T. C. Chamberlin	[illegible] .. D. Salisbury.	C. R. Van Hise.		F. D. Adams.	
	Keeweenawan (Nipigon)	PROTEROZOIC	Keeweenawan	ALGONKIAN ...	Keeweenawan	NEO-PROTEROZOIC ...	Keeweenawan-Athabasca
Huronian	Upper (Animikie)		Animikean		Upper Huronian		Upper Huronian or Animikie-Nastapoka
	Middle		Huronian		Middle Huronian	MESO-PROTEROZOIC ...	Middle Huronian
	Lower				Lower Huronian		Lower Huronian
Keewatin		ARCHÆOZOIC (Archæan Complex)	Gr[illegible] Granitoid Series	ARCHÆAN ...	Keewatin	EO-PROTEROZOIC ...	Keewatin
Eruptive Contact					*Eruptive Contact*		*Intrusive Contact*
Laurentian			Gre[illegible] Schist [illegible]		Laurentian		Laurentian

NOTE.—The horizontal lines indic[illegible] of unconformities; Double lines are used to designate the major unconformities.


TASMANIA
SCALE OF MILES
5 10 15 20 25 30 35
PRE-CAMBRIAN
I
II
III
IV
V
VI
VII
VIII
IX
40
41
42
43
145
146
147
148
27.7.1909



GENERALIZED SECTIONS

L. Keith Ward
27.7.1909

NOTES ON THE GLACIAL BEDS OF FREESTONE-BLUFF (SANDY COVE) NEAR WYNYARD. (PL. IX., X., XI., XII.)

By Fritz Noetling, M.A., Ph.D., etc.

(Read October 18th, 1909.)

(1) HISTORICAL SUMMARY.

The first description of the geological features of the coast near Wynyard was given forty years ago by Mr. T. Stephens (1) in a paper read before this Society. In this paper Mr. Stephens drew special attention to the conglomerates at the mouth of the Inglis, and, after mentioning the occurrence of large angular blocks of granite and porphyry, he goes on to say—" These massive blocks of granite and other rocks which are not now found in situ within several miles of their present position, I consider to furnish more conclusive evidence of glacial agency in the geological history of Tasmania than I have met with elsewhere. . . ." As to the age of this conglomerate, Mr. Stephens says:—" It underlies unconformably the tertiary freestone, which has been determined by Professor M'Coy to be of miocene age, and it contains boulders derived from rocks which are certainly not older than the lower carboniferous or Devonian period."

Mr. Stephens was therefore the first to recognise the glacial origin of the " conglomerate " near Wynyard, and, though he does not exactly say so, the inference from the above passages is that he considers these beds to be of carboniferous age. Mr. Stephens, though perhaps not the first who advocated a palaeozoic glacial period, was certainly among the first who did so, and, what is more, he was the first who recognised the palaeozoic glacial period in Tasmania.

(1) Remarks on the Geological Structure of Part of North Coast of Tasmania, with special reference to the Tertiary Marine Beds near Table Cape. Proceed. Roy. Soc. Tas., 1869, pag. 17.

Twenty years later Mr. R. M. Johnston published his Geology of Tasmania. On page 258 of the standard work on Tasmanian Geology, Mr. Johnston gives the following section of the bluff near Sandy Cove, in descending order—

4. Basalt, of palaeogene age.	Eocene.
3. Turritella—group.	
2. Crassatella—bed.	
1. Conglomerate and shale.	Silurian.

Mr. Johnston is of the opinion that the basalt conglomerate and shale are of silurian age, and that the Turritella group, as well as the Crassatella bed, belong to the Eocene. The age of the basalt is not exactly stated, though it is included in the palaeogene epoch. (See also: R. M. Johnstone, Further Notes on the Tertiary Marine Beds of Table Cape, Pap. and Proceed. Roy. Soc. Tas., 1876, pag. 79; a very instructive though somewhat diagramatic section of Freestone Bluff accompanies this paper.)

Montgomery (1) visited this part of Tasmania about seven years later, and he dwells on the peculiar features of the conglomerate, which he terms "Wynyard formation." He thinks that it forms the base of the permo-carboniferous series, and he agrees with Stephens as to the glacial origin. Waller (2), who writes a few years later, fully corroborates Stephens and Montgomery's views.

In 1902 Kitson (3) publishes an exhaustive paper on the glacial beds near Wynyard. If I am not very much mistaken he was the first to recognise that numerous boulders were scratched. Kitson mentions quite a number of different rocks he found in the glacial drift, and from his list it is evident that rocks of the crys-

(1) Report on the Mineral Fields of the Gawler River, Penguin, Dial Range, Mount Housetop, Table Cape, Cam River, and portion of the Arthur River districts. Rep. of the Sec. of Mines, Tasmania, 1895-96.

(2) Report on the Recent Discovery of Cannel Coal in the Parish of Preolenna, and upon the New Victory Copper Mine, near the Arthur River. Rep. of the Sec. of Mines, Tasmania, 1901-02, pag. 77 ft.

(3) On the Occurrence of Glacial Beds at Wynyard, near Table Cape, Tasmania. Proceed. Roy. Soc. of Victoria, Vol. XV. (New Series), Part I., 1902 pag. 28.

talline series preponderate. He also mentions a boulder containing silurian fossils, which had been found by Mr. Stephens, the fossils being described by R. Etheridge, jun. (1). Kitson concludes his paper with the remark that the glacial origin of these beds is beyond doubt. He is, however, less certain as to its age, but it is evident that he accepts Montgomery's view, viz., that these beds form the base of the permo-carboniferous series.

The last who dealt with these glacial beds is Mr. Stephens, who published forty years after the appearance of his first paper another one dealing with the geological features of the North-West Coast (2), in which he still more emphasises the views expressed in his first paper.

In company with Mr. Stephens I visited Wynyard in February, 1908, and during my examination of the strata at Sandy Cove Bluff I made an observation, which may be of far-reaching consequence not only for the interpretation of this outcrop, but for the geology of Tasmania on the whole. I intended to visit Wynyard again before publishing my notes, but as it is not very probable that I shall find time during the coming summer, and as others may visit Sandy Cove Bluff in the meantime, I wish to draw the attention to the peculiar features I observed, with a view to have them either confirmed or refuted. Before discussing this particular point, I will briefly describe the sequence of beds.

2. THE SEQUENCE OF BEDS AT FREESTONE BLUFF (SANDY COVE). (PL. IX.)

In descending order we see—

(c) Basalt.
(b) Sandstone with fossils.
(a) Clay with scratched boulders.

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(1) Description of Remains of Trilobites from the Lower Silurian Rocks of the Mersey River, and Brachiopoda from the Conglomerate of Table Cape. Pap. and Proceed. Roy. Soc., Tasmania, 1882, pag. 158.

(2) Notes on the Geology of the North-West Coast of Tasmania from the River Tamar to Circular Head. Proceed. Linnean Soc., New South Wales, 1908, Vol. XXXIII., pl. 4, pag. 752 ft.

These three divisions represent the primary natural subdivision of the series exposed at Freestone Bluff (Sandy Cove), and I think that there cannot be the slightest doubt about this. Difference of opinion enters only when we discuss the age and the relations of these three divisions, but before touching this intricate point it will be well to describe shortly their main features:—

(a) Clay with scratched boulders. (Glacial drift or Wynyard formation.)

The glacial drift is well exposed along the outlet of the Inglis, and thence it can be followed in western direction past Freestone Bluff along the shore almost as far as Table Cape, where it disappears underneath the overlying sandstone. In eastern direction it can be followed close up to Woody Hill Point; the total length of exposure along the coast being about six miles (1). From Freestone Bluff towards Table Cape there is a decided dip towards west, but this dip does apparently not continue across the Inglis river, because if it did the glacial drift ought to be at a much higher level near Woody Hill Point than it is. Here it appears at sea level exactly as at Freestone Bluff, and we must therefore assume that the eastern portion from Woody Hill to Freestone Bluff is fairly level, and that the dip commences only west of the last-named point. It is prtety certain that it extends for a considerable distance in northern direction, because at low tide the boulders can be traced far to the north.

How far towards north the moraine extends is difficult to say, but I feel inclined to think that it extends at least as far as the 20-fathom line, about 10 miles from the shore.

At Freestone Bluff at least 20 to 25 feet of thickness are exposed, but for the present it is impossible to state the entire thickness, which must be considerably more.

We do not know the strata on which the moraine rests, but there is every reason to assume that it rests on schists of pre-cambrian age, which form the larger portion of the North-West Coast.

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(1) See also Stephens' Notes on the Geology of the North-West Coast, etc. Lin. Soc., New South Wales, 1908, Vol. XXXIII., pag. 752.

The character of this boulder clay is that of the glacial drift, so well known in Northern Europe and Northern America (see Pl. X. and XI.). More or less rounded sub-angular blocks of rocks, many of which are striated, are irregularly embedded in an argillaceous matrix. This feature is particularly well seen from Freestone Bluff towards the Inglis River, but on turning round the corner of the bluff it loses its character as a boulder clay; the boulders are almost absent, and, what is more, the clay becomes stratified, strangely contrasting in appearance with its former characteristic development. The boulders appear again further towards west, and this certainly proves that the character of the moraine locally changes considerably. Further investigations of this point are very desirable.

Unfortunately my time was too short to make a complete collection of the different kinds of rocks occurring, but I noticed that crystalline rocks form far the majority. Sedimentary rocks are very scarce; I found a boulder of greyish limestone without fossils, and though I searched very carefully I did not find any trace of permian fossiliferous rocks. On this point apparently all observers agree; neither Mr. Stephens, nor Mr. Kitson, nor myself found boulders of rocks of permian age. Kitson enumerates quite a number of different kinds of rocks, and I have no doubt that if a systematic collection is made, and the rocks correctly determined, we will be able with great certainty to fix the geological features of the country whence they came, and thus probably locate their origin.

Most of these boulders are strongly striated and scratched. On the whole these ice-worn boulders are not very common, but I succeeded in finding two perfect specimens of considerable size.

There is another feature connected with these boulders which, if I am not mistaken, was first noticed by Kitson. Almost all the boulders are intersected by a number of parallel cracks running approximately north-south. These cracks are indicative of a great lateral pressure, which did not affect the softer matrix, but broke the more rigid boulders (Pl. XII.). It is very probable that these cracks or joints indicating a pressure from north are the result of the subsidence of the earth's surface when Bass Straits was formed.

At several places I noticed towards the top of the glacial drift lenticular masses of hard quartzite sandstone. Mr. Kitson is inclined to consider these as transported blocks. I rather think them to be solidified aranaceous concretions, which were eventually subjected to the same process of pressure as the boulders (Plate X.).

I am, further, not quite certain whether the apparent stratified condition of the moraine may not also be due to pressure. However that may be, it is certain that the moraine was subjected to an enormous pressure.

(b) Sandstone with Fossils.

Immediately above the moraine follows a layer of coarse conglomerate, which was unquestionably derived from working up the top part of the moraine and redeposit of the more larger blocks. These boulders are cemented by a sandy matrix containing numerous fragments of shells, sometimes also a more complete specimen. About 2 feet above this occurs a very constant bed of fossils about ½ to 1 foot in thickness (Pl. X. and XI.), which has been called Crassatella-bed by Mr. Johnston. This Crassatella-bed is rather peculiar; though very constant in level and thickness, it is not separated by planes of bedding from either the lower or upper portions of the sandstone. It looks as if the fossils had been more concentrated at a certain time during the deposit of the sandstone than either before or afterwards. When we closely examine the fossils we see that they consist for the greater part of broken and rolled fragments, while complete specimens are not very common. It is obvious that the Crassatella-bed forms an old sea beach—in fact, there is not the slightest difference between it and a modern beach along our coasts. Mixed with the fossils, and immediately above the bed, there are numerous rolled small pebbles of whitish or yellowish quartzite, such as I have seen in the tin-bearing deposits on the North-East Coast (1).

Above the Crassatella-bed follows a series of about 80 feet of thickly bedded sandstone, of yellowish white

(1) This is one of the observations hitherto apparently unnoticed.

colour. This sandstone is rather calcareous, and pretty hard. The most common fossil is a small Curritella, which has been called T. Warbartonii, and from which the whole series has appropriately been called Turritella sandstone. The fossils, which are exactly the same as those occurring in the Crassatella-bed, are more sparsely distributed, but now and then they occur in heaps, just as we find them along our shores at the present day.

Besides these marine fossils leaves of terrestrial plants in particular Sapotacites oligoneuris, Etting. and others were found (1), but the most interesting is a nearly complete skeleton of the marsupial Wynyardia bassiana Spencer (2). It may perhaps seem somewhat surprising to find the remains of terrestrial plants and animals in marine deposits, but a little consideration will show that this is not surprising at all. In fact, it would be more surprising if these remains had not been found. The Turritella-sandstone represents a typical deposit formed along the beach, where the land was not far away; leaves from the trees growing close by were frequently blown into the water, and the strand was also frequently visited by animals (3), whose remains became now and then embedded in the sandstone.

The Turritella-sandstone dips slightly towards west, and the higher beds, which are inaccessible at Freestone Bluff, descend more and more towards the sea level the further we move towards west.

I am unable to say whether a subdivision of the Turritella-sandstone is possible or not. If we distinguish the Crassatella-bed as a special palaeontological horizon, we must of course distinguish the strata above and below it. It will perhaps be possible to establish a certain subdivision, particularly if it could be proved that the terrestrial remains occur only in the upper portions, but a good deal of work remains still to be done before we can say something definite.

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(1) Pap. and Proceed. Royal Soc. Tasmania, 1886, pag. xx.

(2) Proceed. Zoolog. Soc., London, 1900, pag. 776-795.

(3) At the mouth of the Ringarooma River I noticed numerous tracks of the native cat (Dasyurus viverrinus) among the sand dunes and along the beach, showing that this animal is in the habit of frequenting the sea shore.

(c) Basalt.

The last of the series is a cap of basalt, having a thickness of about 80 feet. Mr. Johnston is of the opinion that this basalt is of very recent age (1). I am unable to say anything with regard to the relations of the Sandy Cove basalt and the Trachy-dolerite of Table Cape. Mr. Stephens thinks that the Turritella-sandstone was deposited against the Trachy-dolerite of Table Cape. This would imply that the Table Cape rock is much older than the Turritella-sandstone—in fact, that Table Cape already formed a promontory as to-day at the time when the Turritella-sandstone was deposited. I do not agree with Mr. Stephens on this point, because if this were so the beds ought to dip away from Table Cape, but not towards it; besides, I think that the Turritella sandstone is somewhat altered nearing Table Cape. I think that there is not much reason to assume that the Sandy Cove basalt and that of Table Cape are of such widely different age as they would be if Mr. Stephens' view were correct.

The actual observations of the strata as exposed near Wynyard can therefore be summarised as follows:—

"There exists a fairly thick glacial drift unconformably overlaid by an arenaceous littoral formation with fossils capped by basalt."

The question now arises, what is the age of these deposits? Before discussing this problem, I wish to mention another observation I made, which, though of the greatest importance, has apparently never been noticed by previous observers. When I examined the top part of the glacial drift, with a view to ascertain the relations between it and the Turritella-sandstone, I noticed small lenticular layers of fossiliferous sandstone, each showing the small quartz pebbles embedded in the boulder clay, and later on I found rather a long layer of this sand (Pl. XI. and XII.). There is no question that these fossiliferous layers, undistinguishable from the standstone above, were embedded in the moraine, but the problem is to decide whether they are moraine, but the problem is to decide whether they are primary deposits contemporaneous with the moraine or

(1) Geology of Tasmania, pag. 259.

secondary infiltrations so to speak, which were formed long after the deposit of the moraine. It will be seen that it is of the utmost importance with regard to the age of the moraine as well as the Turitella-sandstone to decide this question one way or another.

(3) AGE OF THE BEDS AT FREESTONE BLUFF (SANDY COVE).

Montgomery, Waller, and Kitson believe that the glacial drift belongs to the palaeozoic area, and forms part of the permo-carboniferous, or, as we would say, permian formation, whose lowest or basal bed it represents.

Above the palaeozoic moraine rests a fossiliferous sandstone supposed to be of eocene age (1). I have never been able to find out on what palaeontological proofs the view of the eocene age of the Turritella-sandstone has been based. If the list of fossils described from this formation is carefully studied (2), it will be seen that practically all species are new. Not one of them could be identified with species from true eocene rocks either in Asia or Europe. Further, that characteristic fossil of the eocene, the genus nummulites, is entirely absent, though in Europe it occurs under the same latitude in large numbers. I rather feel inclined to think that the proofs for the eocene age are negative, and not positive. In the older geological manuals we find Sir Charles Lyell's rather fetching percentage theory being accepted as an absolute certain guide for the subdivision of the tertiary formation. This theory assumes that the percentage of living forms decreases in descending order; that is to say, there are a smaller number of living species in the Miocene than in the Pliocene; and, again, they are far less in the Pliocene than in the Miocene; and the smallest number of all occur in the Eocene. More modern investigations have, however, proved that the percentage theory must be

(1) I may state here that Prof. M'Coy was originally of the opinion that these beds are of Miocene age. (See Johnston Geology of Tasmania.)

(2) Reference List of the Tertiary Fossils of Tasmania. Pap. and Proceed. Royal Soc. of Tasmania, 1886, pag. 124 ft. (See

used with the greatest discretion only, and unless supported by other evidence it is at times completely misleading.

This certainly applies to the fauna from the Wynyard sandstone. There is not the slightest reason to assume that it would be of Eocene age because none of the species could be identified with specimens living nowadays. The fauna of Bass Strait is a very modern one; it can have only migrated to its present habitat after the formation of Bass Strait, and it is a priori very probable that it has very little in common with the much older fauna from the Turritella-sandstone.

But let us assume for the sake of argument that the Turritella-sandstone is of Eocene age. The inclusions of fossiliferous sand in the upper part of the moraine seem to indicate a close connection between the glacial drift and the overlying fossiliferous sandstone. This being so, we have established the existence of a Tertiary, that is to say Eocene glacial period. Now, however, different the opinions of geologists may be, there is not one dissenting voice with regard to the climate of the tertiary period. They all agree that the Tertiary was a period of warmth, but not of cold. The establishment of a tertiary glacial period in Australasia would be so much in opposition to all accepted views that it required much better and stronger proofs than we have now before we could accept this theory.

Now, let us presume that the moraine is of palaeozoic—that is to say, of Permian age. In that case, the fauna of the Turritella-zone would also be of permian age, a theory whose absurdity must even strike a beginner in palaeontology. Whatever the age of the Turritella-sandstone may be, its fauna is of such a modern habitus that anything else but a tertiary or post tertiary age is out of question.

It is therefore certain that neither the eocene age of the Turritella-sandstone nor the palaeozoic age of the glacial drift satisfactorily accounts for the intimate relationship between the two as indicated by the fossiliferous inlayers. This could only be explained if we were to assume that the moraine is of diluvial age, or, as it is generally called out here, pleistocene age.

The pleistocene glacier deposited its debris in a sea, which became later on inhabited with the Turritella fauna. Gradually the sea encroached on the land, the upper parts of the moraine were worked up and re-deposited as a conglomerate bed, while small inlayers of fossiliferous sand became mixed up with the upper parts of the moraine.

The Turritella-sandstone would therefore be of post glacial age, and the basalt would be younger still.

As far as I can see there could be two objections to this theory, viz., the cracks in the boulders and the supposition that the inlayers of fossiliferous sand are secondary infiltrations.

I have shown above that almost all the boulders are intersected by a series of parallel fissures. If sandstone and moraine belonged together, one would assume that the cracks continued into the sandstone, and that the larger fossils were broken in a way similar to the boulders. If my memory does not deceive me, I never noticed such a feature, though I must confess I did not pay much attention to it at the time. However that may be, even if the cracks did not extend to the Turritella sandstone, we might assume that the subsidence of land which caused the pressure also opened an inroad for the sea, in which the younger Turritella sandstone was deposited. Though the boulders in the older moraine were therefore broken, the same pressure did not affect the younger Turritella-sandstone.

The other objection is the more serious of the two. In order to make it fully understood, we will accept for the moment the old theory that the moraine forms the base of the permian rocks, and that the Turritella-sandstone is of tertiary (eocene) age. We would then have one of the most stupendous discordances known in the history of the earth. The whole of the mesozoic formation, viz., triassic, jurassic, and cretaceous periods, even a part of the younger palaeozoic (middle and upper permian) would be missing.

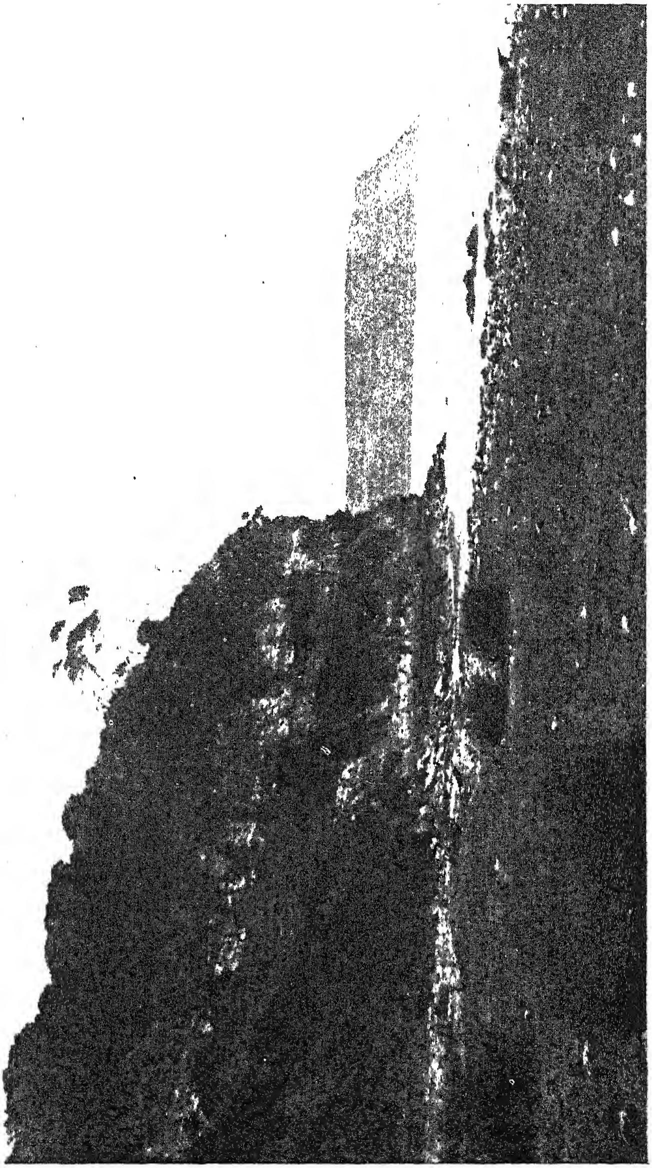
I do not wish to enter into the discussion whether the strata representing these periods were always missing or have been removed by subsequent denudation. All I wish to point out, that if the views hitherto held

regarding the age of the strata at Freestone Bluff (Sandy Cove) be correct we have Eocene resting immediately on the basal bed of the Permian.

Now, all throughout Tasmania the permian formation above the basal glacial drift is represented by a series of great thickness, consisting of mudstones, limestones, and coal measures, the latter being followed by those of younger, probably mesozoic age. Now, we must either assume that not a foot of this great thickness of strata had been deposited near Wynyard, or that they all were removed by subsequent denudation.

It is impossible to assume that they were not deposited near Wynyard, because if the glacial drift, i.e., the basal moraine, had formed the surface of the earth ever since the early Permian, it would probably be disintegrated to such an extent that it would be hardly recognisable. We cannot measure yet the absolute time that lapsed between the beginning of the permian and that of the tertiary epoch, but whatever it may have been it must represent an immense period. Is it imaginable that during this almost immeasurable time the boulder bed forming the surface all the while became so little disintegrated that it remained as fresh as it appears today? I think not, and we must therefore assume that the younger strata, mostly of permian age, were removed by denudation. This at once raises another difficulty—why was the denudation so energetic just near Wynyard that it removed practically all traces of the permian beds, and why was it not so eneregtic in other parts of Tasmania?

Presuming this strange phenomenon did take place; the younger strata disappeared and the surface of the glacial drift was laid bare; about that time a great subsidence of land took place to the north of Wynyard; the pressure thus created broke the boulders and opened fissures in the moraine which became subsequently filled up with fossiliferous sand from above. There is no doubt that this theory is a very fetching one, and it would be possible to reconcile the palaeozoic age of the moraine with the kainozoic age of the Turritella-sandstone. There is, however, one drawback; so far I have not seen a single instance where cracks of the kind required were connected with the Turritella-sandstone.



FREESTONE BLUFF, NEAR WYNYARD (TABLE CAPE IN THE BACKGROUND).

LENTICULAR MASS OF SANDSTONE IN THE MORAINE, OVERLAID BY THE CRASSATELLA BED.

GLACIAL MORAINE SHOWING A LAYER OF FOSSILIFEROUS SAND IMBEDDED IN ITS TOP PORTION.

THE CENTRAL PORTION OF THE LAST PLATE ENLARGED. THIS SHOWS THE FOSSILIFEROUS LAYER MORE DISTINCTLY.

These cracks should be vertical, or at least nearly so, such as shown in the boulders. Though I searched hard, I could not find a single instance. The fossiliferous inlayers in the moraine were all more or less horizontal and disconnected with the Turritella-sandstone. Further examinations would be required to prove conclusively that the fossiliferous inlayers are later infiltration, and not contemporaneous with the moraine. For the present the evidence goes more in favour of the latter than of the former view.

The strongest point in favour of a palaeozoic age of the moraine is the seemingly entire absence of boulders of younger than permian age. We know for certain that the moraine must be of post silurian age, because boulders containing silurian fossils have been discovered in it. The absence of permian boulders does, however, not necessarily mean that it must be of pre-permian age, though it is, I admit, a very strong point in favour of this view. We know, however, so little about the boulders contained in the moraine, that we cannot say with certainty that they do occur; and, further, if they do not occur, we have always to consider the probability that the glacial debris was derived from places where there were no permian strata.

At present the case stands therefore like this: Unless it be conclusively and without the slightest doubt proved that the fossiliferous inlayers in the glacial drift are subsequent infiltrations, we must assume that the moraine and the Turritella-sandstone belong to one and the same epoch. As no sane geologist would consider the fauna of the Turritella-bed to be of palaeozoic age, and as the assumption of an eocene glacial period would be contrary to all experience, we must assume that both the moraine and the Turritella-sandstone are of diluvial (pleistocene) and post diluvial age.

GEOLOGICAL NOTES ON THE COUNTRY TRAVERSED BY THE DERWENT VALLEY RAILWAY EXTENSION.

(PLATE XIII.)

By T. Stephens, M.A., F.G.S.

(Read November 8, 1909.)

The great basaltic sheet, once continuous from Macquarie Plains to Glenora, ends somewhat abruptly on the Northern slope of the valley of the River Styx. Whether it originally extended farther is uncertain, but the probability is that its advance was barred by thick-bedded tertiary sands and clays corresponding to those exposed in the bed of the Derwent near Macquarie Plains, and covered in pre-basaltic times by a great accumulation of drift gravels, the greater part of the whole formation being subsequently removed by denudation. Half a mile from the Glenora station the new line passes through solid basalt, the continuity of which is broken by an irregular band, the determination of the character of which will require a more careful examination than is practicable on a flying visit. It is loosely compacted, and some of it has the appearance of volcanic tuff. But the interesting feature is that, scattered through the formation are crystalline patches of opal varying in colour from pure white to dark brown. There are also faint but unmistakable traces of fossil wood. It was from this same sheet of basalt that the fossil tree was unearthed near Macquarie Plains, which was described by Sir Joseph Hooker some seventy years ago, and is now a conspicuous object in the Natural History branch of the British Museum. It has been identified by Mr. Newell Arber as a species of Cupressinoxylon*.

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*Cupressinoxylon Hookeri, sp. nov., a silicified tree from Tasmania. By E. A. Newell Arber, M.A., F.L.S., F.G.S. Geological Magazine, January, 1904.

The origin of the specimens of agate, carnelian, and various forms of chalcedony, which are often found in gravels of the Derwent basin, or ploughed up in basaltic soils, has always been something of a mystery, but the occurrence of these opals in situ points to our Tertiary basalt as one of the sources from which they have been derived.

The basaltic country which has been described abuts against a rather lofty rise of deep bedded gravels with quartzite boulders up to about eight or ten inches in diameter. The summit of the hill is, by aneroid, about 440 feet above sea level. These gravel beds show no sign of local glaciation, but may be moraine matter brought down by post-glacial erosion. Before any definite conclusion can be formed respecting the history of these gravels and boulders, it will be necessary to investigate the history of similar deposits in other parts of the Derwent basin. On the slopes of the eroded sandstones between Glenora and Hamilton, some 200 feet above the present river level, are lines of travelled shingle and waterworn boulders, and a similar deposit lies high up on the ridge between Hamilton and Upper Broadmarsh. These may be regarded as the remains of terraces on the margin of ancient lakes long since drained by erosion of the river bed. But it is to be noted that none of these deposits are of local origin. All the material consists of quartzites, schists, and indurated sandstones, which have come from the far distant Western country, and their distribution is suggestive of some form of glacial transport.

Approaching Fenton Forest the line passes through a small rise of sand and fine gravel. On the right are the hop grounds and paddocks occupying what was the bed of one of the numerous lakes of the Derwent Valley before the river cut its way through the barrier of basalt near Macquarie Plains. So far there was no formidable obstacle to the construction of the railway; but from near the Forest gate the cuttings for a distance of nearly two miles are through massive diabase of an unusually refractory character. At two and a half miles from Glenora was the maximum difficulty of the whole line. The diabase of Eastern Tasmania is notoriously one of the hardest and toughest of rocks, but here there was

not only the difficulty of getting in the drills deep enough for effective blasting, but the rock is so unusually hard and splintery that there was no avoidance of serious damage to face and hands in the subsequent breaking up with the hammer. The depth of the cutting at this point is about 14 feet. The diabase is rudely columnar, and resting upon it is a band of altered sandstone (Plate XIII.), the section showing more conclusive evidence of the presence of an intrusive sill than I have seen elsewhere inland, though similar sections are common enough on the shores of Tasman's Peninsula, Bruni Island, and the Channel. Towards the western end of this cutting the sandstone is much dislocated by the lifting agency of the intrusive rock. About half a mile farther on is a long cutting through altered mudstone, the diabase only showing here and there. The general dip is about E.S.E., and in this direction it will pass under a neighbouring lofty hill of sandstone, which is normally the next member in the ascending series. The differences in level and the changes in the direction of dip of the sedimentary rocks along the whole route show that they have been much disturbed and faulted by the intrusive diabase, which everywhere underlies them at a greater or less depth in the form of sills or laccolites.

At 3¼ miles, at a sharp bend in the Russell Falls River, is a fine section showing columnar diabase underlying altered and much jointed mudstone.

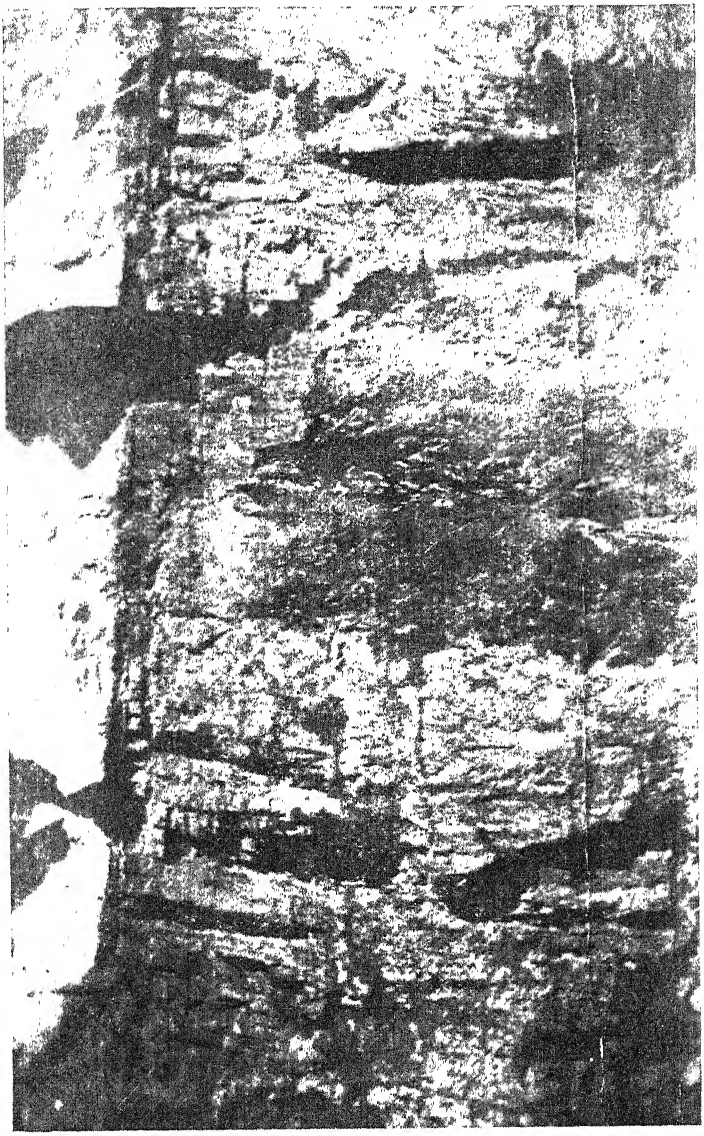
The diabase shows itself here and there for the next mile, but is mostly hidden by sand and gravel, and the waste of the mudstone which is the bed rock of this part of the district. At 5¼ miles a cutting was taken through mudstone of normal character, but with a change of dip to S.W. The next cutting is through mudstone at first in regular bedding, but towards the Western end large loose angular blocks of the same rock were met with, together with rounded boulders of quartzite and other ancient rocks, and occasionally of diabase. One weathered block of the last named measured 3 feet by 2 feet, with a thickness of about 7 inches. The next cutting is through soft sandstone lying conformably to the mudstone. This is the last appearance of the sedimentary rocks, and the terminus of the line stands on sandy clays and gravel thinly covering massive diabase.

The character of the country from this point may be briefly described. To the West and South-West are lofty ridges of diabase, which is continuous for about three miles on both sides of the gorge occupied by Russell Falls River. The first change is shown in outcrops of thick bedded mudstone and sandstone, and these are succeeded by Permo-Carboniferous marine beds brought into view by strong faults. The same broken and faulted country continues up to the head of the valley, where these marine beds crop out on the Southern flanks of Mt. Field at an elevation of over 2,000 feet. To the east at a lower level are great bands of Ordovician limestone with a northerly strike, and to the west are rugged ridges of quartzite and conglomerate, with bands of limestone, and traces of the Cambrian sandstone which I have elsewhere mentioned as occurring at the head of the Florentine Valley. The discussion of the mutual relations of these rocks is, however, outside the limits of this paper. It may, however, be noted that, as was pointed out in a paper read before this Society in 1896,* that the valley of the Russell Falls River is the first stage of the only practicable route for communication by road or railway between Hobart and the West Coast, whether it be in the near or the far distant future.

In concluding these somewhat fragmentary notes, it only remains to consider whether this district supplies any proof of glaciation in past ages, and it must be admitted that the evidence is not very clear. The typical mudstone, which is one of the most widely distributed of South-Eastern sediments, is an upper member of the Permo-Carboniferous marine series. It is noticeable for the number of erratics of large size that are contained in it, and is almost certainly of glacial origin. The stupendous intrusion of diabase, which now caps all the mountains and most of the hills of Eastern Tasmania, is mostly stripped of its original covering of sediments, the remnants of which are seen in isolated patches, or abutting against the flanks of the mountains, where they have been protected from erosion by accumulations of talus. It is hard to conceive any agency but

*Land routes for exploration of the Western Country. By T. Stephens, M.A., F.G.S. Read 10th August, 1896.

that of an ice sheet which could affect such extensive denudation. Its occurrence would probably be towards the close of that Mesozoic period of which we have so little accurate knowledge, and there seems to be no other way of accounting for the rounded character of all the lower diabase-capped hills, resembling gigantic roches moutonnées. It has been established that there was a further glaciation in the Western Country in Tertiary or post-Tertiary times, and, assuming that similar conditions prevailed on the Southern mountain ranges, one might safely conclude that the main features of this district were roughly shaped by moraine-bearing glaciers descending from the Mt. Field range, the existing configuration of the country being due to post-glacial erosion under high pluvial conditions. So far there is little positive evidence in support of this theory beyond the presence of a few erratics, and the steep slightly terraced slopes of the Permo-Carboniferous beds where they bound the valleys, a contour widely different from that of rocks eroded by running water. In such a district as this it is futile to expect to find the evidence of polished rock surfaces, or striated pebbles and boulders, for none of the rocks over which the glacier would pass are hard enough to offer any resistance with the sole exception of the diabase, and that would be broken up rather than smoothed.



DIABASE, WITH OVERLYING SANDSTONE.

POINTS IN THE MORPHOLOGY AND ANATOMY OF CERTAIN MEGAPODES.

(PLATE XIV.)

PART I.—THE PTERYLOSIS.

PART II.—THE MYOLOGY OF THE HIND LIMB.

T. THOMSON FLYNN, B.Sc.
Lecturer in Biology, University of Tasmania.

(Read November 8, 1909.)

INTRODUCTORY.

It is unnecessary, I think, to commence a series of papers on the Anatomy of the Megapodes by an apology. That such a series should seem to be necessary is, perhaps, to be wondered at, the more so when the special nature of this remarkable group of birds is considered. Some work has indeed been done, but in general it has been directed to special features to be used for taxonomic purposes. Such notes are, therefore, scattered about in numerous papers on the anatomy of birds, a good many of which, here in Tasmania, are quite unavailable to me. When we consider that even in the matter of the pterylosis of the group probably the only complete account of any member is contained in two papers—one by Garrod, on the anatomy of "Megacephalon maleo," the other by Pycraft, on the pterylosis of "Megapodius pritchardi," we get some idea of the necessity of a systematic investigation of the group.

My material consists of a number of specimens of two genera, "Catheturus lathami" (the "Scrub Turkey") and "Lipoa ocellata" (the "Mallee Fowl").

In the case of the latter I have not as much material as could be desired, but any new facts noted with the arrival of further specimens will be embodied in later papers. In addition, I have a chick (12 days hatched) of "Megapodius eremita," on the pterylosis of which I make some notes, but which I have not dissected.

I have to tender my sincerest thanks to Prof. W. A. Haswell, of Sydney, without whose kindly advice and assistance in obtaining literature this work could not have been undertaken.

The specimens were all obtained through the assistance of the fund of the John Coutts Scholarship, of Sydney University, of which for one year I was the holder. A single exception is the young specimen of "Megapodius eremita," obtained through the help of F. Young, Esq., of the s.s. "Upolu," who brought it from the Solomon Islands, preserved in diluted gin. I am deeply indebted to him for the opportunity of examining this valuable specimen.

PART I.—PTERYLOSIS.

The feather arrangement of the group seems, singularly enough, to have been almost neglected, the only papers available to me on the subject being those of Nitszch (Proc. Ray Soc., 1867), containing a brief account of the pterylosis of "Megapodius rubripes"; Garrod (Proc. Zool. Soc., 1878, pp. 629-631) on the anatomy of "Megacephalon maleo," and Pycraft (Willey's Zool. Res., Pt. IV., 1900, pp. 483-491) being "A Contribution towards our Knowledge of the Pterylography of the 'Megapodii'").

In his remarks on the pterylosis of "Megapodius rubripes," Nitzsch stated that it was typically gallinaceous in character, and that the oil gland was tufted. Garrod, however, found that in "Megacephalon maleo" the oil gland was nude, and that the rest of the feather arrangement differed in some respects from the typical galline character. Pycraft deals in an extended manner with the pterylography of "Megapodius pritchardi" and of a nestling of "Megapodius eremita." In his paper he raises a number of points of interest. Unfortunately, this paper has only recently come into my hands, and since the plumage of my 12 days' old chick of "M. eremita" is worthy of detailed study in connection with several points emphasised by Pycraft, I have decided to withhold all remarks upon it till later.

In "Catheturus lathami" the head is almost bare, the feathers of this region being scanty, reduced, and bristle-like. In the supra-orbital region, however, and anterior to this region, the feathers are slightly longer, being about half an inch in length. The anterior part of the neck is occupied by the large "wattle," which is sparsely covered by a number of bristle-like feathers, which, on the posterior side, take more the character of contour feathers.

"Lipoa" differs greatly from "Catheturus" in this region. The head is comparatively thickly covered with well developed feathers, which are raised above into a distinct crest. Anterior to the eyes, and extending backwards below and behind them to surround the auditory

aperture, is a paired white space, bare except for a few bristles (absent in "Catheturus"), which surround this aperture in a double row.

In the posterior neck region, in "Catheturus," the lateral neck spaces are broad and well defined. The ventral tract begins in this region, and as it passes backwards divides into two strongly-marked pectoral bands, which diverge some distance in front of the sternum, and are carried down on each side towards the thigh, just anterior to which (about the mid length of the sternum) they suddenly cease. The rest of the ventral tract is wholly separated from the pectoral bands by well-marked spaces. This other part commences just anterior to the manubrium sterni, and immediately divides, the two tracts running backwards and only meeting just anterior to the anus. The two tracts diverge greatly in the abdominal region before meeting.

The arrangement in "Lipoa" is almost exactly similar to the above, there being the two strong pectoral tracts which are separated from the ventral tract proper, the latter becoming divided into two tracts, which meet in this case some distance anterior to the anus, forming a diffused tract on the abdomen.

The dorsal tract in "Catheturus" is bounded laterally on the neck region by the two large neck spaces. It is continued caudad as far as a point lying shortly behind the shoulder joint, where it abruptly ends in fairly long and strong feathers. When the tract begins again, it becomes diffused over the entire pelvic region as a broad area, so wide as to be fused with the femoral tracts on either side. The oil gland is nude.

In "Lipoa," the arrangement of the dorsal tract is similar. There is a large space, as in "Catheturus," connecting the lateral spaces of the trunk. The oil gland here again is nude.

The humeral and femoral tracts are well developed in each of the two genera, the latter being fused with the posterior expanded portion of the dorsal tract.

The distribution of the feathers on the wings agrees in both of the specimens examined. The number of remiges is :—Metacarpals, 10; cubitals, 15. In each the

first cubital is equally well developed with the rest, though not quite so long. The cubitals are graduated, the eighth being the longest. Both genera are quincubital, markedly differing in this respect from "M. pritchardi" and "M. eremita."

The dorsal major tectrices of the primaries are well developed, but not so long as the cubitals, these latter being graduated, the first (in "Catheturus") being in length 5¼ inches, the seventh (the longest) measuring 6½ inches.

The dorsal tectrices mediae of the secondaries are fairly large, and are graduated, there being no sudden differences in length between adjacent feathers. Those of the primaries are feeble, and on the manus they are almost deficient.

The dorsal tectrices minores do not call for special mention.

On the ventral side the tectrices majores are well developed, the tectrices mediae are absent, and the minores are scattered and feeble.

The rectrices number 16 in each of the two genera.

In a number of specimens of "Catheturus" there is present in the mid-ventral apterium a patch of specially thickened skin. It is roughly rhomboidal in shape, with its long axis (about two inches) extending along the carina sterni posteriorly. Its short axis measures about ¾in., and the skin covering it, though specially thickened, is not at all scaly.

REMARKS.

All the genera of the Megapodidae so far described resemble the typical gallinae in a number of points in their feather arrangement, but most especially in the fact that the two parts of the ventral tract unite before reaching the anus. They, however, agree with one another, and differ from the typical gallinae in the possession of the interrupted ventral tract, the presence of the large dorsal interscapular space and the fusion of the

lumbar with the dorsal tract. It seems possible that the Megapodidae are capable of being divided into two groups. The first of these have the oil gland tufted, and are aquincubital. This group would probably be found to include all the species belonging to the genus "Megapodius," but at any rate includes "M. eremita" and "M. pritchardi." The second group would include those genera with a nude oil gland and quincubital wing, comprising the genera "Catheturus," "Lipoa," and probably "Megacephalon," although we have no evidence yet, in the case of this genus, as to the wing being diastataxial or otherwise.

PART II.—MYOLOGY OF THE HIND LIMB.

Myologically, I have as yet examined only two genera of the Megapodidae — "Catheturus" and "Lipoa." These two genera agree almost exactly in the arrangement and distribution of the muscles, such differences as are noticeable being in the main due to the disparity in the length of the hind limb. That of the Mallee Hen is much shorter than the Brush Turkey, being only three-quarters the length. In both cases the enormous strength of the leg muscles is very noticeable, particularly as regards the muscles of the thigh. The size of these muscles is much greater than in Gallus. The great size of the posterior thigh muscles in these birds results in the drawing out of the post-acetabular portion of the sacral region. The acetabulum, therefore, which lies about half-way between the two ends of the pelvis in Gallus, comes to about one-third of the distance from the anterior end. The enormous thickness of the thigh muscles, anterior as well as posterior, results in the deep hollowing out of the sides of the pelvis external to the ilio-ischiatic crest.

The thigh contains the usual muscles of the Gallinaceous birds, the tensor fasciae, the semitendinosus and accessory semitendinosus, the femoro-caudal and its accessory, and the ambiens. Certain points, some of which may be characteristic, are worthy of note in connection with these muscles. The gluteal muscles are well developed, and are four in number—primus (tensor fasciae), medius, minimus, and quartus—the latter being a short, chunky little muscle having its origin at the posterior outer margin of the ilium for a short distance, and passing backwards, slightly downwards and outwards, to be inserted into the outer side of femur just below the trochanter and slightly below and anterior to the insertion of the gluteus medius.

The semitendinosus and its accessory are surprisingly well developed, the latter being nearly as long as broad (one and a half by one and a quarter inches). The arrangement of the femoro-caudal muscle is interesting in these genera. According to Garrod (P.Z.S., 1873, pp. 626-644) in most birds "it arises from the (anterior)

transverse processes of the two last coccygeal vertebrae, and is inserted into the linea aspera of the femur at about one-third of its length from the trochanter." In my specimens I have found the insertion exactly as stated by Garrod, but when the muscle is traced out towards the tail the arrangement is found to differ remarkably from that laid down by him. The muscle on each side is found to spread out into a thin aponeurotic sheet, the two uniting and covering the lower side of the muscles of that region. The shape of this muscle, remarkably enough, varies in the two genera. In the Brush Turkey it is long and ribbon-like, while in "Lipoa" it is much expanded and thin, so that its centre part comes to be leaflike. This latter condition in "Lipoa" may, however, be due to the pressure of overlying muscles in preservation. The accessory head, however, agrees in both genera in being large and fan-shaped, rising along a fairly extensive line posterior to the ischiatic foramen, covering in this position the lower half of the hollow, which lies external to the ilio-ischiatic crest. Centrally this muscle is thinned, consisting only of an aponeurosis, through which can be seen the tendon of M. obturator externus.

The arrangement of the semimembranosus is interesting in these birds. In "Gallus" this muscle rises from the outer edge of the ischium, but its origin does not extend so far back as to completely cover the ischio-pubic foramen. In "Catheturus" and "Lipoa," however, this foramen is completely covered, so that with the lengthening of the origin the muscle comes to be fan-shaped. In company with the semitendinosus, it forms the posterior contour of the thigh.

M. ambiens has much the usual insertion, bending round the knee over the patella, to become merged with the head of M. perforatus digiti iii., but its origin is worthy of comment. It is not, as usual in birds, a thin, spindle-shaped muscle; but owing to the fact that it arises from both the pectineal process, and some small portion of the bone behind it, it comes to be triangular.

The muscle representing the pyramidalis, called by Gadow the ilio-femoralis externus, and by Owen and Selenka, the glutaeus externus, is also present in the

Megapodes, as in "Gallus," but is more powerfully developed in the former. It is a well developed, triangular muscle, rising fleshy along the posterior third of the preacetabular crest and from the hollow below this, then passing directly over the head of the femur, rapidly narrows to a pointed tendon, which is inserted into the outer side of femur just below the trochanter above the insertion of gluteus minimus.

The obturator muscles (internal and external) show nothing of special interest except that the area of origin of the latter is triangular.

In the shank muscles, a special feature is the strong ossification in some of the tendons, so complete that often they may easily be broken in two with a sharp blow. In the presence of this ossification almost all the shank muscles are alike, but it is more particularly confined to the peroneous longus, the tibialis anticus and the soleus.

M. extensor digitorum communis in the Megapodes rises from the hollow between the pro and ecto-cneminal crests of the tibia, partly also from the outer side of the latter and from the upper third of the anterior face of the bone. It passes, as usual, under the bony and ligamentous bridges at the proximal end of the tarso-metatarsus. About two-thirds the distance down this latter bone it bifurcates, forming an outer and inner slip.

The latter passes to the base of the second digit, where it again divides into an outer slip (A) and an inner (B). (A) is ribbon-like, and divides into two, one of which forms the fibrous bridge of slip (B), the other the fibrous bridge at the base of digit iii.

Slip (B) divides also into two, the outer of which crosses over the inner to become inserted into the base of the second phalanx. The other division of slip (B) passes along the outer side of the second digit to be inserted into the base of the ungual phalanx. The rest of the tendon of M. extensor digitorum communis is distributed in the usual manner, dividing at the base of each phalanx into two, one of which is inserted into the base of each phalanx, the other continued onwards to the base of the next.

The extensor brevis digitorum of Owen is present in these birds underlying the last-named muscle. It runs along the sulcus in front of the tarso-metatarsus, and is attached to that bone for the main part of its extent. Just underneath the point where the extensor communis digitorum first bifurcates, the present muscle is converted into a tendinous expansion, which is hardly differentiated into tendons, but of which separate parts are inserted into the bases of the proximal phalanges of digits ii., iii., and iv. From the side of the body of the muscle, and about half-way down the tarso-metatarsus, a small portion takes its origin, which passes to the hallux, and is inserted into the base of the movable metatarsus of that digit.

M. abductor digiti iv. is a small muscle rising externally to the origin of m. perforatus hallucis (vide infra) at the proximal end of the tarsus. It passes down the postero-internal aspect of the bone, being attached to it for some considerable part of its extent. About two-thirds down this bone it develops a tendon, which passes externally to the joint between the foot and the metatarsus, to be inserted into the outer side of the base of the proximal phalanx of the fourth digit.

There is a strong vinculum joining the deep flexor of the foot with the flexor longus hallucis, as found by Garrod to be the case in the Gallinae in general. In addition, there is another, not nearly so evident a vinculum, joining M. flexor perforatus digiti iii. to M. perforatus et perforans digiti iii.

This latter vinculum occurs just behind the joint between the metatarsus and the pes. It merely joins together the two tendons in that position.

M. perforatus hallucis is present, rising by two fleshy heads, the larger from the hollow lying on the inner side of the hypotarsus, the lesser from a similar but smaller concavity on the outer side. In this position, the tendon of the deep flexor overlies it, and passes down in a grove between the partially distinct bellies of the muscle. The lesser head develops a tendon much in advance of the larger, the two running then side by side until they fuse. The compound tendon is attached

to the base of the first phalanx of the hallux, but is perforated in this position by the tendon of M. flexor longus hallucis.

The method by which the two muscles M. flexor perforans digiti iv. and M. flexor perforatus digiti iv., are made to act on five phalanges is interesting in these birds. The arrangement in M. flexor perforans is simple. It perforates the tendon of M. flexor perforatus, and passes to the ungual phalanx, being inserted into it in two places, at the base of the terminal phalanx, and also a little in advance of this, just at the base of the nail. It gives off also small slips to the penultimate and ante-penultimate phalanges of this digit.

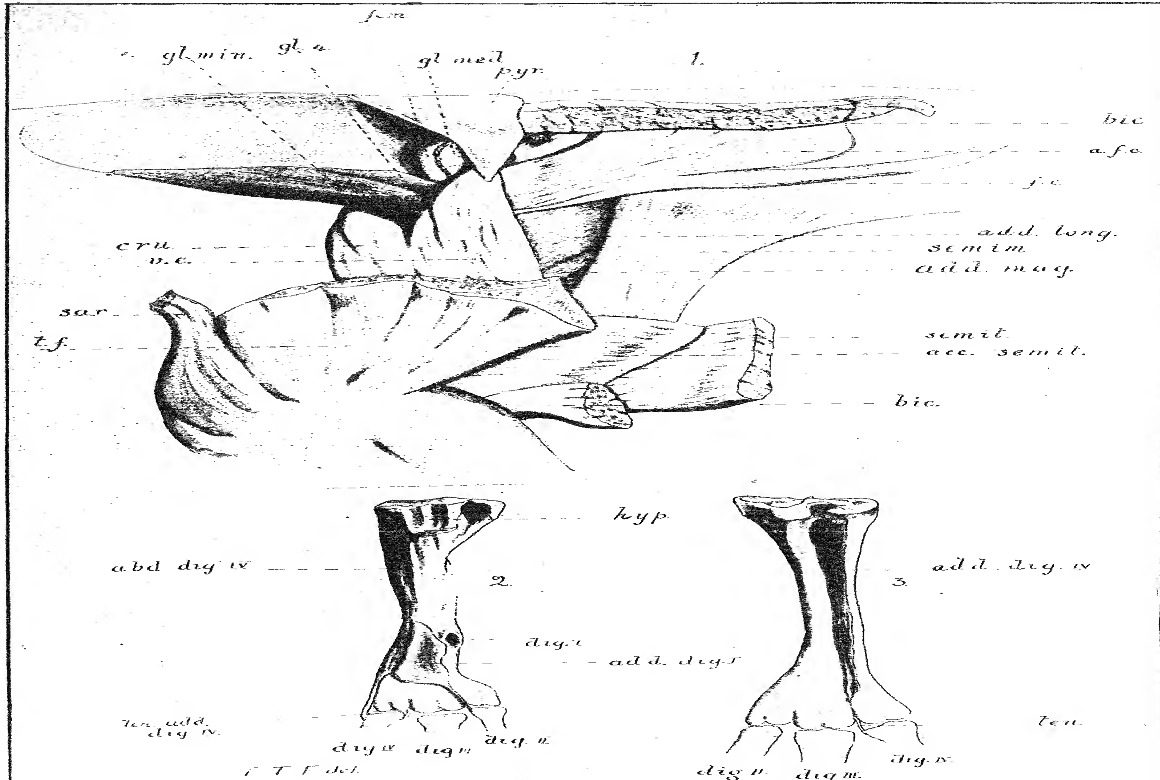
The perforated flexor, of course, becomes divided into two parts—an inner and an outer. The inner of these passes to be inserted into the base of the fourth phalanx, giving off also a slip to the third. The outer slip divides almost immediately into two, of which one becomes inserted into the base of the third phalanx, while the other divides again into two, one part being inserted into the base of the first phalanx, the other into the base of the second.

M. adductor digiti iv. About this muscle Gadow (Bronn's Thier-reichs, Aves, p. 204-5), says:—" Diesen Muskel, der nicht in der Literatur erwahnt ist habe ich nur bei sehr wenigen Vogeln gefunden: Bei Rhea (nicht bei den ubrigen Ratiten gesehen) entspringt er als ein sehr dunner Muskel fibular neben dem M. abductor dig. ii. und ist theilweise mit dem ihn lateral begrenzenden M. abductor dig. iv. verwachsen. Seine Sehne geht durch das Spatium intertarsale externum zur Tibialseite der Basis phal. i. und adducirt die Aussenzehe neben geringer Plantarflexion. Bei Bucorvus entsprang er von distalen Ende der Tarsus: bei Rhampastus war er noch kurzer und nutzlos."

In the Megapodes, it arises from the upper part of the anterior aspect of the tarso-metartarse, and from part of that bone as well as from the side of the extensor brevis digitorum. It is a thin spindle-shaped muscle, which develops a thin rounded tendon passing down-

wards in a canal between the metatarsals of digit iii. and iv. to be fixed on the inner side of the base of the proximal phalanx of digit iv.

M. adductor digiti ii. is present as a small muscle rising from an area of the distal end of the tarsus, and underlying all the tendons of the deep flexors. It ends in a tendon which is inserted into the infero-lateral base of the proximal phalanx of the second digit.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EXPLANATION OF FIGURES.

FIGURE I.—"Catheturus lathami," dissection of muscles of thigh.

The overlying gluteus primus has been removed except the distal portion (t.f.). The biceps and semitendinous have only their proximal and distal portions left. All the gluteus medius has been removed except its tendon.

acc. semit. . . . . accessory semitendinosus
add. long. adductor longus
a.f.c. . . . . accessory femoro-caudal
bic. . . . . biceps flexor cruris
f.c. . . . . femoro-caudal
fem. . . . . head of femur
gl. min. . . . . gluteus minimus
gl. med. . . . . gluteus medius
gl. 4 . . . . gluteus quartus
pyr. . . . . pyramidalis
semim. semimembranosus
semit. . . . . semitendinosus
t.f. . . . . tensor fasciae
v.e. . . . . vastus externus

FIGURE 2.—"Catheturus lathami," back view of the tarso-metatarsus.

h. . . . . hypotarsus
abd. dig. iv. . . . . abductor digiti iv.
add. dig. i. adductor digiti i.
ten. add. dig. iv. . . . . tendon of m. adductor digiti iv.
dig. i. . . cavity left after removal of metatarsal of digit i.
dig. ii., dig. iii., dig. iv. . . . . proximal phalanges of digits i., ii., iii., iv.

FIGURE 3.—"Catheturus lathami," front view of the tarso-metatarsus.

add. dig. iv. . . . . adductor digiti iv.
ten. . . . . its tendon

REPORT

OF THE

ROYAL SOCIETY

OF

TASMANIA

FOR THE YEAR

1909.

Hobart.

Printed at "The Examiner" and "Weekly Courier" Offices,
73-75 Patterson Street, Launceston.

ANNUAL GENERAL MEETING.

The Annual General Meeting of the Royal Society was held in the Society's Room, Museum, on Thursday, 3rd March, 1910.

In the absence of the President (His Excellency Sir Harry Barron) Mr. Thomas Stephens, M.A., F.G.S., the senior Vice-President, occupied the chair, and the Annual Reports for 1909 were submitted.

RE-ELECTION OF RETIRING MEMBERS OF COUNCIL.

There being no other nominations, the retiring members of the Council (Messrs. R. M. Johnston, Russell Young, Dr. Noetling, and Dr. Webster were re-elected.

ELECTION OF FELLOWS.

Messrs. Robert C. Kermode and H. Minchin Nicholls were elected Fellows of the Society.

AUDITOR.

Mr. H. W. W. Echlin was reappointed Auditor.

REPORTS OF SECTIONS.

The Medical Section reported, through their Secretary (Dr. E. W. J. Ireland) that the Section had a membership of twenty-one during the year, three of the members being resident in the country. Two had resigned at the end of the year on their departure from Hobart. Two new members were elected. The Annual Meeting and six Ordinary Meetings were held, and were well attended. Several meetings were devoted to the discussion of the Midwifery Act, and some suggested amendments were submitted to the Hon. the Chief Secretary for consideration. The Section thanks the Royal Society for the annual grant of £12, which has been devoted to the purchase of books. Their accounts of receipts and expenditure showed a credit balance of £14 17s.

ANNUAL REPORT FOR 1909.

The Council of the Royal Society have the honour to present their Report for 1909 to the Annual General Meeting of the Society.

His Excellency Sir Harry Barron, K.C.M.G., shortly after his arrival to assume the office of Governor of the State, was

pleased to intimate his acceptance of the position of President of the Society.

Seven Monthly General Meetings and one Special General Meeting were held during the year. Eleven Ordinary Meetings and four Special Meetings of the Council were held during the same period.

Twenty-nine Fellows were elected, one Associate became a Fellow, and thirteen Fellows and one Associate allowed their membership to lapse, and the deaths of three Fellows were recorded. The total number of Members of the Society were one hundred and thirty-nine Fellows, including nine Life Members and two Associates. Sir Ernest Shackleton was elected an Honorary Member.

Two vacancies occurred in the Council through the resignation of Sir Elliott Lewis and Dr. Elkington, and were respectively filled by the election of Dr. G. A. Webster and Dr. Arthur Clarke.

At a Special General Meeting on August 9, 1909, Rule 44 was altered by striking out the last paragraph, which referred to an Address by the President at the first Monthly General Meeting in each year.

The Committee appointed to arrange the Library Fund found it necessary to sort out the Society's own publications before attempting the work in the Library Room, because it was discovered that the set of the Society's own publications in the Library was incomplete.

This task proved to be more difficult than it was anticipated, because the back numbers had got mixed up with all sorts of useless printed matter, and stock had apparently not been taken for years.

After a considerable amount of work the Committee succeeded in bringing together a complete set of the Society's publications from 1845 up to date; the volumes were bound in their original covers, and the set now in the Library is probably the only complete set of the Publications of the Royal Society of Tasmania. Copies of the missing Annual Reports were also found, and two complete sets from 1845 to 1892 were bound.

The aggregate number of the back volumes is 2,759 in all, which, valued at 1s. per volume, represent an asset of £137 19s.

The following Papers were read during the Session of 1909:—

Records of Tasmanian Botanists, by J. H. Maiden, F.L.S. (Corresponding Member).

A Peculiar Group of Tronattas, by Fritz Noetling, M.A., Ph.D.

Red Ochre and its Use by the Aborigines of Tasmania, by Fritz Noetling, M.A., Ph.D.

The Minerals of Tasmania, by W. F. Petterd, C.M.Z.S.

The Tasmanian Onagraceae, by L. Rodway.

The Speech of the Tasmanian Aborigines, by Hermann B. Ritz, M.A.

Notes on the Occurrence of a Fossil Tree embedded in Drift on the North-West Coast of Tasmania, by T. Stephens, M.A., F.G.S.

Rocks Used in the Manufacture of Tronattas, by Fritz Noetling, M.A., Ph.D.

On the Applications of Multenions to Metageometry, by Prof. Alex. M'Aulay, M.A.

Notes on the Names given to Minerals and Rocks by the Aborigines of Tasmania, by Fritz Noetling, M.A., Ph.D.

A Contribution to the Geology of Tasmania, by L. Keith Ward, B.A., B.E.

Note on Brachycome melanocarpa, Sonder, by L. Rodway.

Notes on the Glacial Beds at Freestone Bluff, Sandy Cove, near Wynyard, by Fritz Noetling, M.A., Ph.D.

Geological Notes on the Country traversed by the Derwent Valley Railway Extension, by T. Stephens, M.A., F.G.S.

Points in the Anatomy of Certain Megapodes, by T. Thomson Flynn, B.Sc.

A Balance-sheet, duly audited, showing the receipts and expenditure for 1909, is appended.

The Report was adopted without amendment.

RECEIPTS AND EXPENDITURE, 1909.

GENERAL ACCOUNT.

RECEIPTS.

1909.	£	s.	d.
Jan. 1—Balance from 1908	30	13	7
Subscriptions of Fellows—107 at 30s. and 23 at 20s.	183	10	0
Subscriptions of Associates—2 at 15s.	1	10	0
Rent of Room, Field Naturalists' Club	5	5	0
Sale of Books, Duplicates, etc.	27	0	0
Sale of Copies of Proceedings and Papers	3	1	8
	£251	0	3

EXPENDITURE.

1909.	£	s.	d.
Grant to Medical Section	12	0	0
Secretary to the Council—Salary	50	0	0
Attendant—Wages	7	10	0
Messrs. Rolph and Young—Printing Papers and Proceedings for 1908	33	15	0
Ditto—Printing for 1909	0	10	0
Messrs. Davies Bros.—Printing and Advertising	7	17	3
Mr. W. R. Propsting—Books, etc.	2	0	0
Messrs. Walch and Sons—Magazines, etc.	6	16	5
Insurance of Books	2	5	0
Postage	8	13	6
Auditors' Fee	1	1	0
Messrs. Wheatley and Co.—Agency	2	0	4
Messrs. Strutt and Co.—Freight	0	5	3
Messrs. J. C. Tolman and Sons—Fuel	0	11	0
Rubber Stamp Co.—Cancellation Stamp	0	5	0
Mrs. Arnold—Refreshment at Monthly Meetings	6	0	0
Bank Charges, Exchange, etc.	0	14	8
Petty Cash	1	7	7
	£143	12	0
Balance to 1910	107	8	3
	£251	0	3

LIFE MEMBERS' COMPOSITION FEES.

	£	s.	d.		£	s.	d.
Balance from 1908	1	0	0	Nil.			
				Balance to 1910	1	0	0
	£1	0	0		£1	0	0

THE MORTON-ALLPORT MEMORIAL FUND.

	£	s.	d.		£	s.	d.
1909.				Messrs. Walch and Sons—Books—			
Jan. 1—Balance from 1908	2	8	7	Geikie's Geology, 2 vols.	3	3	0
Mar. 12—Interest Received from Trustee	4	12	6	Chamberlain and Salisbury, Geology, 3 vols.	3	10	0
Sept. 30—Interest Received from Trustee	4	12	6	Smith's Stone Age	0	18	0
				Igneous Rocks	0	15	0
				Darwin and Modern Science	1	1	0
				The Heart of Antarctica	2	2	0
					£11	9	0
				Balance to 1910	0	4	7
	£11	13	7		£11	13	7

BERNARD SHAW, Hon. Treasurer.

I have this day examined the Books and Vouchers of the Royal Society of Tasmania, and found them correct and in accordance with the Balance-sheet.

H. W. W. ECHLIN.

Hobart, February 9, 1910.

LIST OF FELLOWS AND ASSOCIATES

OF THE

ROYAL SOCIETY OF TASMANIA.

*Fellows who have contributed Papers read before the Society.
†Life Members.
The Addresses of Members residing in Hobart are omitted.

FELLOWS:

Agnew, L. E., Mrs.
Allwork, F., L. S. A., *New Norfolk.*
Archer, Wm. Henry Davies, *Longford.*
Anderson, G. M., M.B., C.M., *Franklin.*
Armstrong, Hugh, F.R.C.S.
Ash, Percy.

†Baker, Henry D..
Barclay, David.
†Baring, Rev. F. H., M.A., F.R.G.S., *Spring Bay.*
*Beattie, J. W.
Bennett, Wm. Henry, *Ross.*
Bennison, Thomas.
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Blackman, A. E.
Brain, Rev. Alfred, M.A.
Brownell, F. Leslie
Burgess, Hon. Wm. Henry.
Butler, Arthur, *Lower Sandy Bay.*
Butler, Francis.
Butler, Hon. Gamaliel Henry, M.R.C.S., M.L.C.
Burbury, Fredk. E., *Launceston*
Burn, William.
Butler, W .F. D., M.Sc.

Campbell, R. D., M.B.
*Clarke, Arthur H., M.R.C.S.
Clerk, Claud.

Counsel, Edward Albert.
Crosby, Hon. William, M.L.C.
Cross, A. R. P., Captain R. A.
Crouch, Ernest J., M.R.C.S.
Cruickshank, James H., Lt.-Col. R.E., *Glenorchy*.

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Davies, Hon. Charles Ellis, M.L.C.
Dechaineaux, Lucien.
Delany, His Grace Archbishop
Dobson, Hon. Henry.
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Elkington, John S. C., M.D.
Ernst-Carroll, F. J., M.Sc., *Neuchatel, Switzerland*.
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Evans, Thomas May.
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†Foster, John D.
Finlay, W. A.
*Flynn, T. Thomson, B.Sc.

†Grant, C. W.
Giblin, Lyndhurst F., B.A.
Giblin, Wilfred, M.B.
Giblin, Alan V.
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*Green, A. O.
Gould, H. T.

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Harrison, Malcolm.
Harvey, Walter A., M.R.C.S., M.B.
Heyer, Rev. J., M.A.
Hogg, G. H., M.D., *Launceston*.
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Hubbard, Leonard.
Hutchison, Hermann.

Ireland, E. W. J., M.B., C.M.

*Johnson, J. A., M.A.
*Johnston, Robert M., F.L.S., I.S.O.

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*Kingsmill, Henry C., M.A.
Knight, H. W.

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Lewis, Major R. C.
Lewis, Hon. Sir Neil Elliott, D.C.L., M.A., K.C.M.G.
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Love, Joseph, M.B.

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McElroy, J. A.

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Macgowan, E. T., M.B., B.S.
*Macleod, P. J., B.A.
Mercer, E. J., Dr. (Bishop of Tasmania).

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Nicholls, Mr. Justice.

Oldham, N.

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†Sticht, Robert, *Queenstown*.
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*Taylor, A. J.
*Twelvetrees, W. H., F.G.S., *Launceston.*
*Thompson, Rev. Edward H.

Walch Charles.
*Ward, L. Keith, B.A., B.E.
Watson, Horace.
Watchorn, Arthur Denison.
Watchorn, E. T., Lieut.-Col.
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Webster, C. Ernest.
Webster, George A., M.B., M.R.C.S.
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Wertheimer, Arnold
*Weymouth, W. A.

Winter, Alfred.
Wise, H. J.
Wolfhagen, J. Edgar, M.B., C.M.
Wolfhagen, Waldemar.

Young, Russell.
Young, Russell, Junior.

ASSOCIATES:

Conlon, A.
Osborne, John, Junior.

Note.—Fellows are requested to notify any errors in their names, titles, or addresses.

I. A. R. I. 75.

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